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FOREIGN AGRICULTURE REPORT
OFFICE OF
FOREIGN AGRICULTURAL RELATIONS
U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

THE CITRUS INDUSTRIES OF NORTH AFRICA

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by

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FOREWORD

As a producer of one-half of the world's citrus supplies the United States citrus industry is keenly interested in the development of citrus in foreign countries. Knowledge of foreign citrus production is essential in evaluating competition in foreign markets and is equally important when foreign production may result in supplies to our domestic market.

This is a study of the most vigorous citrus industry in the Mediterranean area--one which is rapidly becoming a major citrus supplier of Western European markets.

This survey of the citrus industries of North Africa was made in the interests of the United States citrus industry by the Office of Foreign Agricultural Relations as a part of the program to develop foreign markets for agricultural commodities in plentiful supply, utilizing funds of the Research and Marketing Act.

The possibilities of broadening and maintaining foreign markets for other agricultural commodities also are being studied by this Office, and the findings are presented in circulars and reports that may be obtained, free in the United States, from the Office of Foreign Agricultural Relations, United States Department of Agriculture, Washington 25, D. C.

Joseph A Becker

Joseph A. Becker, Chief
International Commodities Branch

ACKNOWLEDGMENT

This study was made possible by the efforts of many persons in Washington and abroad. Foreign service officers and staff members at Casablanca, Rabat, Algiers, and Tunis were extremely helpful.

The author wishes to express his appreciation for the assistance rendered by government departments, particularly Service de l'Agriculture, Direction des Affaires Economiques, at Rabat, Service de l'Arboriculture at Algiers, and Service Botanique at Tunis. Appreciation is also expressed for the help of the many North African citrus growers and processors who took time to show the author their plants and groves.

Acknowledgment is also made to the staff of the Division of Fruits, Vegetables, and Sugar - to Gustave Burmeister for assistance in planning the survey, and to Mrs. Ruth Tucker, Marguerite Golden, and Christine Hudson for assistance with the statistical data in this report.

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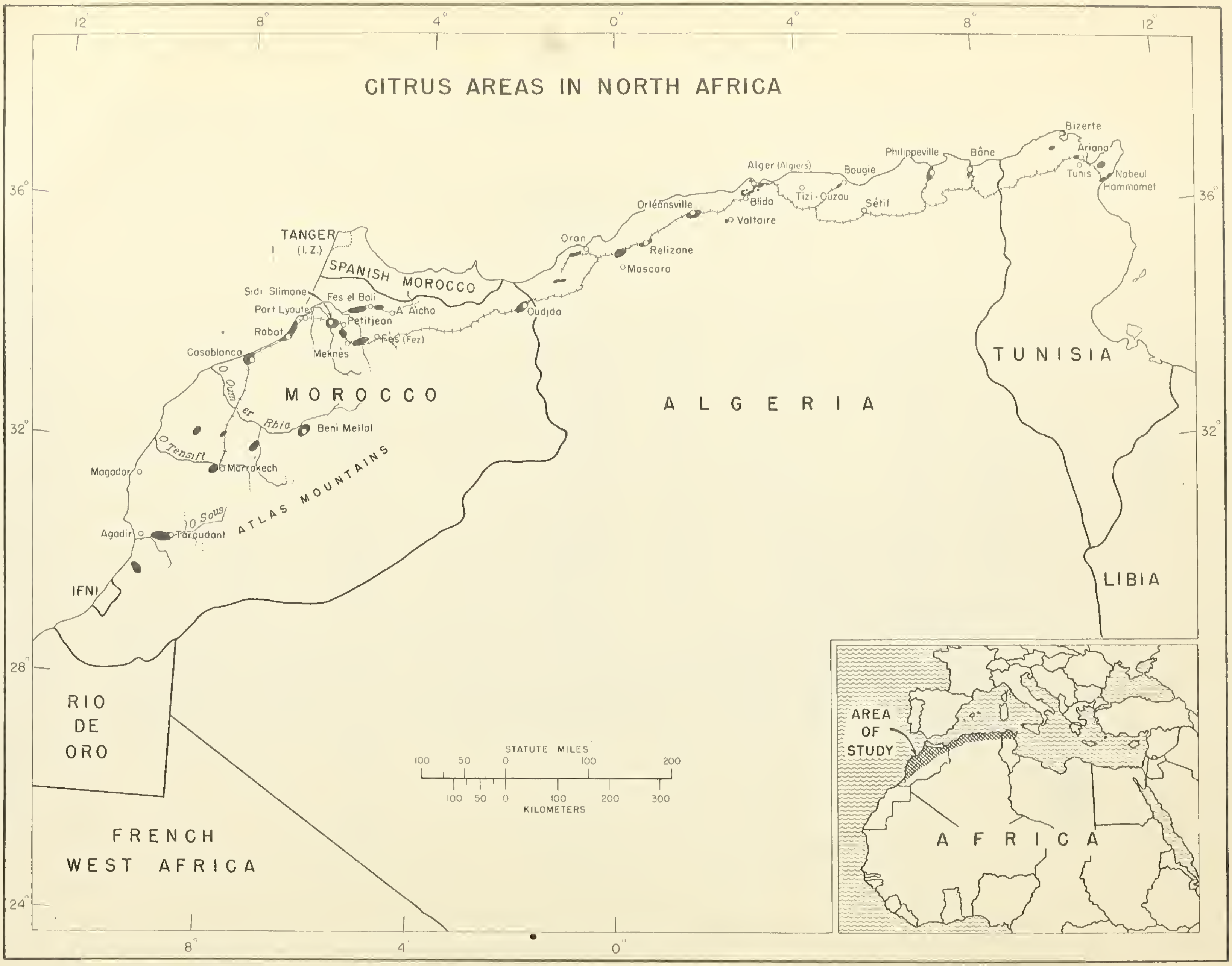
CITRUS AREAS IN NORTH AFRICA



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INTRODUCTION

North Africa is the most rapidly developing citrus area in the Mediterranean. It is a combination of the modern and the primitive. The coastal cities of North Africa, particularly Algiers and Casablanca, are quite modern. New buildings, electric trolley busses, and widespread construction of both industrial projects and homes give one the impression that these are growing countries. This can be contrasted with Western Europe where the older stable cultures do not show any indications of this activity. In Casablanca and Algiers one sees the familiar names of American manufacturers of agricultural and construction machinery. In show rooms and display lots one sees heavy agricultural and construction machinery of all types, including crawler tractors, wheel tractors, and dirt movers. Farming in North Africa is indeed big business, at least insofar as most of the European properties are concerned.

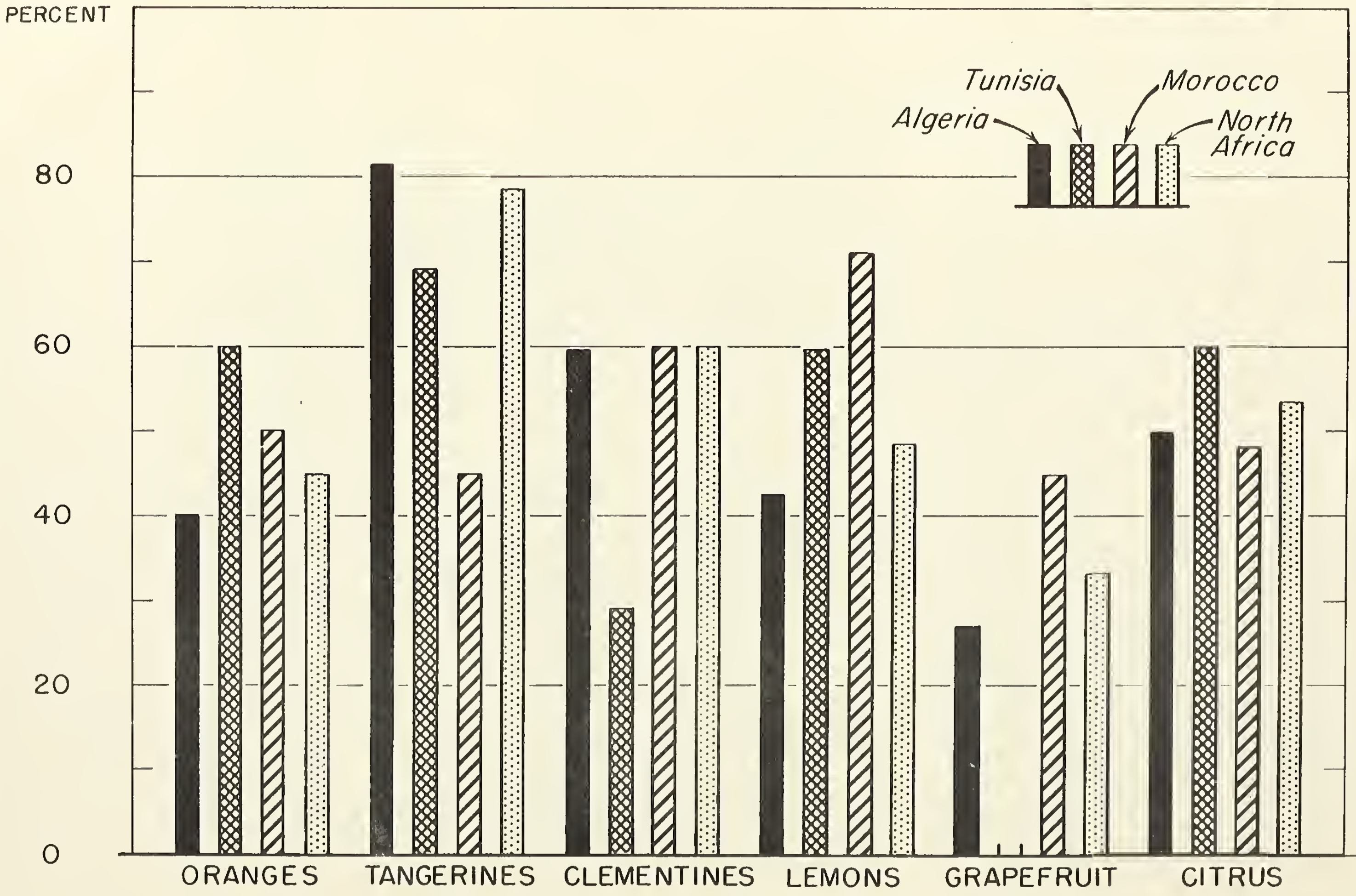
North Africa is a region of great contrasts. In the coastal cities only a few blocks from modern buildings which display heavy equipment and other evidences of modern industrial methods applied to agriculture, one may see herds of sheep being driven down a road or a caravan of camels laden with goods heading for the desert. The vigorous modern western culture of the coastal North African cities is like an oasis in the general cultural patterns of the region, the primitive way of life of the native peoples.

A citrus grower from the United States would feel quite at home in North Africa since he would see familiar things about him. This is quite different from the citrus culture of other Mediterranean areas such as Spain and Italy where hand cultivation is employed and where very different methods of citrus culture are followed.

Two visits were made to North Africa in 1949. The first trip was made between February 15 and March 15--when citrus fruits were still being harvested--and the second trip took place between July 18 and August 19.

These two trips to the major citrus-producing areas included visits to the Cape Bon Peninsula, Hammamet, Beni Kriar, and orchards near Tunis in Tunisia; the districts near Oran, Affreville, Blida, Boufarik, and Algiers in Algeria; and the districts near Marrakesh, Casablanca, Rabat, Sidi Slimane, Petitjean, Meknes, Fes and Fes el Bali in Morocco.

PERCENTAGE OF NORTH AFRICAN CITRUS ORCHARDS
IN PRODUCTION IN 1943 BY AREA AND VARIETY



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SUMMARY

Production

Citrus production in North Africa is increasing rapidly and the 1950-51 crop of nearly 11 million boxes of oranges and over 2.8 million boxes of tangerines and clementines is the highest on record. Algeria is the largest orange-producing area; Morocco is second in importance, producing in 1950-51 about 1 million boxes less than Algeria. Algeria is also the largest producer of clementines and tangerines, and in the prewar years Algeria was primarily a tangerine producing area. Algeria produced the largest crop of lemons in the 1950-51 season followed by Tunisia and Morocco in order. Morocco is the largest producer of grapefruit, which is a minor crop in all areas. Production in 1950-51 was as follows:

	Oranges	Tangerines and clementines	Lemons	Grapefruit
	Boxes	Boxes	Boxes	Boxes
Algeria...	5,360,328	2,311,681	243,666	52,359
Morocco...	4,283,223	554,300	92,825	82,672
Tunisia...1/	1,024,000	1/	203,000	2/

1/ Tangerines are included with "Oranges."

2/ Not available.

Acreage

Of the three citrus districts, Algeria has the largest acreage, followed by Morocco and Tunisia in order. By 1949, the total citrus acreage in the three areas had increased to approximately 120,000 acres, compared with approximately 90,000 acres in 1943.

	1943	1949
	Acres	Acres
Tunisia...	9,012	1/ 10,000
Morocco...	26,823	47,073
Algeria...	55,003	2/ 61,095
Total...	90,838	118,169

1/ Estimated.

2/ 1948.

Exports

Exports of citrus from North Africa are increasing, and both Algeria and Morocco exported over 3 million boxes of oranges in the 1949-50 season compared to exports of less than 150,000 boxes of oranges from Tunisia. In this same season Algeria exported about 1.7 million boxes of tangerines and clementines compared to less than 500,000 boxes for the rest of North Africa. Some lemons were exported in 1949-50 from all three areas with each exporting about 50,000 boxes or less. Morocco is the largest exporter of grapefruit with Algeria next in importance. This fruit is of minor importance in all three areas. Exports in 1949-50 were as follows:

	Oranges	Tangerines and clementines	Lemons	Grapefruit
	Boxes	Boxes	Boxes	Boxes
Algeria...	3,172,939	1,709,636	54,314	22,196
Morocco...	3,024,428	419,378	37,971	51,863
Tunisia...	146,521	71,835	40,124	--

Outlook

The rapid increase in acreage planted to citrus in North Africa, particularly in Algeria and Morocco, will result in increasing production for some years unless climatic disaster or other forces should destroy producing acreage. The high percentage of young acreage is illustrated by the accompanying chart which indicates that in 1943 only about 53 percent of North African citrus acreage was in production. Yields per acre are higher in Morocco and production should increase more rapidly in that area.

Considering these factors it seems possible that by 1960 orange production may reach 8 million boxes in Algeria, 9.5 million boxes in Morocco, and 1.5 million boxes in Tunisia. Lemon production may also increase and by 1960 Tunisia may produce 300,000 boxes, Morocco 250,000 boxes, and Algeria 200,000 boxes. Tangerine and clementine production may reach 3 million boxes in Algeria by 1960 and 750,000 boxes in Morocco. Grapefruit production probably will be largest in Morocco where production may reach 150,000 boxes by 1960. In Algeria, grapefruit production is unlikely to be much in excess of 50,000 boxes prior to 1960. In Tunisia, grapefruit is a minor crop

The possible 1960 citrus crops indicated here for Tunisia should be considered as about the limit of citrus production in that area.

As production increases, exports of citrus will also increase if a market outlet can be found. As larger citrus supplies are available in North Africa, retail prices probably will decline and domestic consumption increase. Morocco is probably in a more favorable export situation than

Algeria because of its location, slightly lower freight rates, and--more important--the seasonal advantage of its citrus which matures earlier than citrus in either Spain or Algeria. The ability to meet competition in European markets other than France and Germany is yet to be proved in all North African citrus areas. Considering these factors, it is possible that by 1960 orange exports may reach 4 million boxes in Algeria, 6 million boxes in Morocco, and 0.5 million boxes in Tunisia. Algeria's exports of tangerines and clementines will probably continue to be large and may reach 2.5 million boxes by 1960 when Morocco may export 0.5 million boxes. Lemon exports will probably remain small and by 1960 may be about 125,000 boxes in Algeria, 100,000 boxes in Tunisia, and 50,000 boxes in Morocco. Grapefruit exports are likely to be minor, and Morocco may export about 75,000 boxes in 1960 and Algeria about 40,000 boxes.

Processing

One modern processing plant is located near Tunisia and there are several near Algiers. The coastal towns of Morocco also have new installations for citrus processing. The plants in all three areas are much the same, being multipurpose plants which process other food products in addition to citrus. One plant in Morocco has equipment to make concentrated juices, the other plants produce single-strength juice which is either canned or preserved with sulphur dioxide and sold in casks for the "squash" market. Among the pulp and peel products produced is dehydrated peel for cattle food. France and the domestic market absorb nearly all present production. Considering the short processing season, and the varieties of fruit produced, the present processing capacity of North Africa may be in excess of the supply of processing fruit and the market for processed products.

Citrus Varieties

Early and midseason varieties are most important in North Africa. The season opens with the clementine followed by tangerines. These types are most important in Algeria where the clementine originated. Important orange varieties are the early Thomson and Washington Navel and the midseason Maltese, Portuguese (semi-blood), Entre Fina and Doble Fina (blood oranges) of Spain. Some late varieties are grown and the Valencia is more favored than the Verna which is popular in Spain.

Cost of Production

The cost of producing citrus and preparing it for market varies considerably between areas, as can be seen from the following comparisons of the cost of producing oranges in North Africa in 1949. (The costs were converted from francs at 320 francs to the dollar.)

Cost of production per 30-kilo (66-pound) box (fruit on the tree) was as follows:

	High Dollars	Low Dollars
Algeria.....	0.45	0.38
Morocco.....	.94	.79
Tunisia.....	.35	.23

The break-even costs f.o.b. ports per 30-kilo (66-pound) packed box were:

	High Dollars	Low Dollars
Algeria.....	1.68	1.28
Morocco.....	2.17	1.69
Tunisia.....	1.60	1.30

Because of the great vigor of the trees and other favorable conditions, French Morocco has the lowest on-the-tree cost of production. Tunisia, with its unfavorable climate, poor water conditions, and light soils, has the highest on-the-tree cost of production.

Comparing the break-even cost f.o.b. ports per packed box, the cost relationships differ slightly owing to distances between the major citrus areas and the ports. In French Morocco, where the primary producing areas are located at least 50 miles from the seacoast, it costs more to ship the fruit to port. Therefore, although French Morocco has the lowest on-the-tree production cost, the break-even costs f.o.b. ports are approximately the same as those for Algeria. The break-even costs from Tunisia are higher than those from either Morocco or Algeria, and the lowest cost in Tunisia is estimated to be approximately equal to the highest break-even cost in Algeria. Therefore, Tunisia seems to be at a slight disadvantage compared to the other two producing areas.

Quality of Fruit

North Africa produces excellent quality oranges which at maturity are highly colored, fine flavored fruit. The blood and semi-blood types are exceptional in quality, and the nonblood types are equal to the best produced in the United States.

I. THE CITRUS INDUSTRY OF ALGERIA

Algeria is the oldest commercial area in North Africa. In the past, it was primarily important in international trade for the production of tangerines, but it has recently changed the character of its citrus industry and is now a major supplier of oranges.

In Algeria one is impressed with the rapid growth of modern and intensive agriculture, particularly in the coastal area surrounding the city of Algiers. Driving through the countryside on shady, tree-lined, well-paved roads, one sees on all sides well-cultivated vineyards and citrus orchards, the deep green of the vigorous foliage standing out against the red and brown soils. Scattered through the vineyards are the towers with their palm-covered shelters where guards sit to protect the ripening crop from pilferage.

Algeria is a great wine country, and there is an enormous acreage which is suitable for citrus but which is now utilized as vineyards.

Citrus is grown by Moslems and by Europeans. The Moslem holdings and production of fruit are relatively small, compared with those of the Europeans. Primarily, the production from Moslem groves is sold domestically, and many of the varieties are not suitable for export. Fruit entering international trade comes primarily from European-operated groves.

Acreage

The changing character of Algerian citrus plantings is indicated by the census of citrus plantings taken in 1943 (table 1).1/ At that time approximately two-thirds of the early orange trees were from 1 to 6 years old; nearly one-half of the other oranges were 1 to 6 years old, and over half of them under 10 years. This is a great contrast to the ages of the tangerine and clementine trees. Only 5 percent of the tangerines were 1 to 6 years old, and the majority were over 10 years of age, some of the orchards having been planted as early as 1885. About one-third of the clementines were 1 to 6 years of age. There was a growing acreage of young lemons, however, and over half of the trees were 1 to 6 years of age, and at least two-thirds were under 10 years of age. The increase in grapefruit acreage is indicated by the fact that 75 percent of the trees were under 10 years of age in 1943.

1/ H. Rebour, Les Agrumes en Afrique du Nord, Union des Syndicats des Producteurs d'Agrumes, Algiers, 1945.

Table 1. - Algeria: Census of citrus plantings, 1943

District and type of citrus	Number of trees: 1 to 6 years	Number of trees: 6 to 10 years	Number of trees: Over 10 years	Number of trees: Total	Area
	Number	Number	Number	Number	Acres
Algiers:					
Early oranges.	561,598	144,673	89,639	795,910	
Other oranges.	557,656	217,544	343,020	1,118,220	
Tangerines....	220,773	85,167	644,522	950,462	
Clementines...	168,546	102,589	122,654	393,789	
Lemons........	41,228	8,834	20,837	70,899	
Grapefruit....	14,692	3,448	6,134	24,274	
Total.......	1,564,493	562,255	1,226,806	3,353,554	26,705
Oran:					
Early oranges.	489,705	82,090	106,524	678,319	
Other oranges.	539,947	129,618	202,715	872,280	
Tangerines....	82,933	43,578	111,455	237,966	
Clementines...	192,748	190,395	136,620	519,763	
Lemons........	46,786	8,090	13,004	67,880	
Grapefruit....	30,625	2,512	2,010	35,147	
Total.......	1,382,744	456,283	572,328	2,411,355	18,504
Constantine:					
Early oranges.	48,921	40,070	16,753	105,744	
Other oranges.	214,846	100,816	150,572	466,234	
Tangerines....	66,454	50,515	168,055	285,024	
Clementines...	54,157	43,846	10,055	108,058	
Lemons........	10,499	7,312	11,617	29,428	
Grapefruit....	758	2,528	477	3,763	
Total.......	395,635	245,087	357,529	998,251	9,793
Total, Algeria:.					
Early oranges.	1,100,224	266,833	212,916	1,579,973	
Other oranges.	1,312,449	447,978	696,307	2,456,734	
Tangerines....	370,160	179,260	924,032	1,473,452	
Clementines...	415,451	336,830	269,329	1,021,610	
Lemons........	98,513	24,236	45,458	168,207	
Grapefruit....	46,075	8,488	8,621	63,184	
Total.......	3,342,872	1,263,625	2,156,663	6,763,160	55,003

Source: H. Rebour, Les Agrumes en Afrique du Nord, Algiers, 1945, p. 33.

Between 1943 and 1948 the acreage planted to citrus increased by approximately 6,000 acres, from about 55,000 to 61,000 acres. The acreage and number of trees in 1948 is given in table 2, and the acreage and production figures for 1946-47 to 1948-49 are given in table 3. The totals of acreage listed by department and district in table 3 are smaller than the citrus acreage summarized in table 2. These discrepancies result from difference in the time at which the census happened to be taken; in other words, they are due to the difference between a crop year and a calendar year, Since the citrus industry of Algeria is changing rather rapidly, a small interval of time can make considerable difference in acreage figures.

Over half of the present citrus acreage is devoted to oranges, about one-third to early oranges, and two-thirds to other varieties of oranges. Approximately one-fifth of the acreage is now planted to tangerines and about 12 percent to clementines. Lemons and grapefruit are still very minor crops.

Clementines: The clementine, an orange-tangerine hybrid sold in European markets, primarily in the United Kingdom, prior to the Christmas season, has been planted to a considerable extent in Algeria. Approximately 35 to 40 percent of the clementine acreage is located in the Department of Oran. This is not surprising since Oran is the home of the clementine, and the original tree grew in a garden not 10 miles back of the city of Oran. The acreage planted to clementines is not expanding appreciably, and from 1947 to 1949 there was an increase of less than 200 acres as many growers are dissatisfied with this variety.

Tangerines: During the 3-year period 1947 through 1949 there was little change in the acreage planted to tangerines; the 1949 acreage of 11,006 acres was only 94 acres more than the area planted in 1947. The major portion of the tangerine plantings are more than 15 years old. These old orchards are located primarily in the vicinity of the city of Algiers and nearly two-thirds of the tangerine acreage is in the Department of Algiers.

Oranges: Orange acreage in Algeria increased from 29,062 acres in 1947 to 33,586 acres in 1949, and is still increasing. The departments of Algiers and Oran have had about the same acreage planted to oranges, but as new acreage comes into production in the vicinity of Algiers that department will no doubt lead in acreage and production in forthcoming years.

Lemons: The area planted to lemons increased from 1,294 acres in 1947 to 1,453 acres in 1949. The small increase in acreage is associated with a change in the location of the lemon district in Algeria. Some of the older lemon orchards in the interior are being top-worked to orange varieties, since the climate has proved to be too cold or otherwise unsuited to the production of lemons. New groves are being planted on the rather light, hilly soils near the seacoast and north of Algiers. From the quality of fruit and trees in this area, it is likely that the largest production of lemons in Algeria will come from these plantings in future years. The terrain which is suitable to these new plantings is limited, however, and no great expansion of lemon production is to be expected.

Grapefruit: Grapefruit is not a popular citrus variety in the European market and the quality of this fruit raised in Algeria is not as high as that of fruits raised in other citrus areas. The citrus census of 1943 showed many young orchards, but interest in grapefruit production has declined. Between 1947 and 1949, the acreage planted to grapefruit in Algeria decreased from 462 to 356 acres.

New Citrus Plantings

The number of citrus trees in Algeria increased from approximately 2.5 million in 1930 to approximately 7.5 million in 1948. The larger proportion of these plantings was made after 1938, when there were less than 3.5 million trees. From the evidence of existing nursery stock, it seems likely that the number of trees will continue to increase for some time. The primary interest of Algerian agriculturalists is grapes and wines. Much of the land now used in that industry is suitable for citrus production; therefore, there is a very large acreage in Algeria upon which citrus plantings could be made.

Table 2. - Algeria: Citrus acreage and number of trees, by district and variety, 1948

Variety	Algiers		Oran		Constantine		Total	
	Acreage	Number of trees 1/	Acreage	Number of trees 1/	Acreage	Number of trees 1/	Acreage	Number of trees 1/
	Acres	1,000	Acres	1,000	Acres	1,000	Acres	1,000
Early oranges..	8,040	992	5,930	772	1,001	98	14,971	1,862
Other oranges..	10,652	1,315	8,501	1,101	4,969	487	24,122	2,903
Tangerines......	7,591	937	1,611	209	2,723	267	11,925	1,413
Clementines....	3,111	348	3,222	417	1,085	106	7,418	871
Lemons.........	717	88	657	85	294	29	1,668	202
Grapefruit.....	403	50	403	52	185	18	991	120
Total........	30,514	3,730	20,324	2,636	10,257	1,005	61,095	7,371

1/ Does not include groves of less than 25 trees.

Source: Service de l'Arboriculture, Algeria.

Table 3. - Algeria: Acreage and production of citrus, by kind and by district, 1946-47 to 1948-49

Department, district, and land tenure	Clementines						Grapefruit					
	Acreage			Production 1/			Acreage			Production 1/		
	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49
	Acres	Acres	Acres	Boxes	Boxes	Boxes	Acres	Acres	Acres	Boxes	Boxes	Boxes
Department of Algiers												
Algiers:												
Europeans	356	558	519	23,526	28,613	54,832	82	74	64	3,720	7,165	3,417
Moslems	34	50	54	1,906	3,810	5,826	---	10	---	---	1,378	---
Total	390	608	573	25,432	32,423	60,658	82	84	64	3,720	8,543	3,417
Aumale:												
Europeans	---	---	---	---	---	---	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	---	---	---	---	---	---	---	---	---
Blida:												
Europeans	1,567	2,199	1,920	102,199	96,499	148,716	67	62	74	3,858	8,929	6,834
Moslems	79	99	94	6,330	6,330	6,866	2	2	5	110	344	248
Total	1,646	2,298	2,014	108,529	102,829	155,582	69	64	79	3,968	9,273	7,082
Medea:												
Europeans	---	---	---	---	---	---	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	---	---	---	---	---	---	---	---	---
Miliana:												
Europeans	18	15	22	1,392	913	1,512	---	---	---	---	---	---
Moslems	2	---	---	98	---	---	2	2	---	17	344	---
Total	20	15	22	1,490	913	1,512	2	2	---	17	344	---
Orleansville:												
Europeans	143	106	143	3,634	2,428	3,401	10	12	12	207	1,791	1,102
Moslems	18	18	18	819	337	315	---	---	---	---	---	---
Total	161	124	161	4,453	2,765	3,716	10	12	12	207	1,791	1,102
Tizi-Ouzou:												
Europeans	45	54	54	2,661	2,362	2,646	---	5	2	---	716	138
Moslems	22	8	18	1,150	315	787	---	---	---	---	---	---
Total	67	62	72	3,811	2,677	3,433	---	5	2	---	716	138
Department of Oran												
Mascara:												
Europeans	166	166	168	5,505	9,725	15,180	---	---	---	---	---	---
Moslems	2	2	5	136	79	126	---	---	---	---	---	---
Total	168	168	173	5,641	9,804	15,306	---	---	---	---	---	---
Mostaganem:												
Europeans	316	433	277	6,787	6,289	8,126	54	37	17	2,425	3,031	1,378
Moslems	57	32	64	1,213	1,181	2,047	---	---	---	---	---	---
Total	373	465	341	8,000	7,470	10,173	54	37	17	2,425	3,031	1,378
Oran:												
Europeans	2,275	1,678	1,831	130,802	116,938	155,487	59	52	59	3,307	2,756	1,874
Moslems	50	27	30	2,542	1,071	1,575	10	---	---	551	551	---
Total	2,325	1,705	1,861	133,344	118,009	157,062	69	52	59	3,858	3,307	1,874
Sidi-Bel-Abbes:												
Europeans	---	---	18	5	243	315	2	---	2	124	28	193
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	18	5	243	315	2	---	2	124	28	193
Tiaret:												
Europeans	---	---	---	3	3	---	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	3	3	---	---	---	---	---	---	---
Tlemcen:												
Europeans	287	284	366	18,116	22,830	31,841	107	119	42	7,110	4,803	1,819
Moslems	71	74	74	5,001	5,943	5,763	7	12	10	160	295	248
Total	358	358	440	23,117	28,773	37,604	114	131	52	7,270	5,098	2,067
Department of Constantine												
Batna:												
Europeans	---	---	---	---	---	---	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	---	---	---	---	---	---	---	---	---
Bone:												
Europeans	433	408	408	21,246	19,023	22,424	49	47	47	3,858	2,778	3,858
Moslems	32	15	15	1,950	900	189	---	---	---	---	---	---
Total	465	423	423	23,196	19,923	22,613	49	47	47	3,858	2,778	3,858
Bougie:												
Europeans	84	72	72	2,006	2,425	3,527	2	7	7	72	634	1,268
Moslems	5	5	5	211	236	441	---	5	5	11	286	385
Total	89	77	77	2,217	2,661	3,968	2	12	12	83	920	1,653
Constantine:												
Europeans	15	15	7	819	614	630	---	---	---	---	---	---
Moslems	---	---	3	---	---	157	---	---	---	---	---	---
Total	15	15	10	819	614	787	---	---	---	---	---	---
Guelma:												
Europeans	15	15	15	520	189	1,039	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	15	15	15	520	189	1,039	---	---	---	---	---	---
Philippeville:												
Europeans	366	358	358	15,224	28,043	57,666	7	7	7	3	716	992
Moslems	69	67	67	2,570	4,566	9,984	---	---	---	---	---	---
Total	435	425	425	17,794	32,609	67,650	7	7	7	3	716	992
Setif:												
Europeans	---	---	---	---	---	---	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	6,526	6,756	6,622	358,370	361,907	541,418	462	455	356	25,532	36,547	23,755

(Continued)

Table 3. - Algeria: Acreage and production of citrus, by kind and by district, 1946-47 to 1948-49 (Continued)

Department, district, and land tenure	Lemons						Oranges					
	Acreage			Production 1/			Acreage			Production 1/		
	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49
	Acres	Acres	Acres	Boxes	Boxes	Boxes	Acres	Acres	Acres	Boxes	Boxes	Boxes
Department of Algiers												
Algiers:												
Europeans	240	262	250	14,113	16,041	30,081	2,973	3,707	3,709	199,847	280,094	520,727
Moslems	17	15	12	812	1,393	1,480	281	247	232	16,632	19,527	33,321
Total	257	277	262	14,925	17,434	31,561	3,254	3,954	3,941	216,479	299,621	554,048
Aumale:												
Europeans	---	---	---	---	---	---	17	17	15	220	252	252
Moslems	---	---	2	---	---	58	---	---	22	---	---	945
Total	---	---	2	---	---	58	17	17	37	220	252	1,197
Blida:												
Europeans	126	158	200	11,705	12,793	24,889	6,247	6,548	7,203	601,240	517,199	1,144377
Moslems	37	37	42	2,103	2,103	3,916	647	865	719	55,713	50,391	91,963
Total	163	195	242	13,808	14,896	28,805	6,894	7,413	7,922	656,953	567,590	1,236,340
Medea:												
Europeans	---	---	---	---	---	---	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	---	---	---	---	---	---	---	---	---
Miliana:												
Europeans	5	---	---	253	---	---	186	222	242	11,376	13,228	21,826
Moslems	10	---	---	197	---	---	69	62	47	5,055	2,645	4,346
Total	15	---	---	450	---	---	255	284	289	16,431	15,873	26,172
Orleansville:												
Europeans	67	67	67	2,733	3,594	6,179	2,165	2,076	2,236	140,300	162,794	246,380
Moslems	5	5	---	159	38	---	420	420	334	34,061	15,593	21,542
Total	72	72	67	2,892	3,632	6,179	2,585	2,496	2,570	174,361	178,387	267,922
Tizi-Ouzou:												
Europeans	32	32	30	2,219	2,031	2,205	297	469	378	24,707	39,462	35,431
Moslems	10	10	10	624	551	638	284	235	311	17,983	16,503	21,763
Total	42	42	40	2,843	2,582	2,843	581	704	689	42,690	55,965	57,194
Department of Oran												
Mascara:												
Europeans	7	7	10	426	490	493	537	537	578	37,834	79,120	83,775
Moslems	---	---	---	---	---	---	12	12	25	1,279	1,679	1,732
Total	7	7	10	426	490	493	549	549	603	39,113	80,799	85,507
Mostaganem:												
Europeans	84	62	124	7,963	10,675	13,895	2,503	2,377	2,595	182,918	260,001	264,898
Moslems	12	---	14	1,073	1,160	1,914	111	131	148	6,031	10,236	13,354
Total	96	62	138	9,036	11,835	15,809	2,614	2,508	2,743	188,949	270,237	278,252
Oran:												
Europeans	277	339	314	21,794	24,367	30,168	4,903	6,425	7,413	482,299	526,909	942,624
Moslems	7	7	2	142	87	87	212	247	259	14,522	20,096	18,897
Total	284	346	316	21,936	24,454	30,255	5,115	6,672	7,672	496,821	547,005	961,521
Sidi-Bel-Abbes:												
Europeans	---	---	2	6	41	58	20	25	25	211	781	2,866
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	2	6	41	58	20	25	25	211	781	2,866
Tiaret:												
Europeans	---	---	---	---	---	---	2	---	---	6	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	---	---	---	2	---	---	6	---	---
Tlemcen:												
Europeans	69	79	59	7,035	6,976	7,687	1,359	1,211	1,211	137,321	152,889	163,676
Moslems	35	27	23	2,393	2,692	3,713	351	346	346	25,378	51,481	51,399
Total	104	106	82	9,428	9,668	11,400	1,710	1,557	1,557	162,699	204,370	215,075
Department of Constantine												
Batna:												
Europeans	---	---	---	---	---	---	7	7	7	287	441	1,259
Moslems	---	5	5	67	203	261	25	30	30	652	1,795	1,575
Total	---	5	5	67	203	261	32	37	37	939	2,236	2,834
Bone:												
Europeans	69	97	97	5,358	7,188	7,194	2,320	2,392	2,392	158,551	188,723	220,460
Moslems	5	2	2	435	29	493	77	79	79	2,101	6,129	8,031
Total	74	99	99	5,793	7,217	7,687	2,397	2,471	2,471	160,652	194,852	228,491
Bougie:												
Europeans	22	20	39	1,074	1,233	5,396	430	445	445	34,546	34,864	43,242
Moslems	10	10	10	548	624	1,392	556	519	519	27,202	33,403	27,809
Total	32	30	49	1,622	1,857	6,788	986	964	964	61,748	68,267	71,051
Constantine:												
Europeans	2	2	---	3	26	---	62	86	64	2,047	5,864	7,212
Moslems	3	5	---	107	348	---	5	40	27	202	2,331	2,772
Total	5	7	---	110	374	---	67	126	91	2,249	8,195	9,984
Guelma:												
Europeans	10	10	10	534	493	1,624	341	341	341	22,950	20,752	37,730
Moslems	2	2	2	145	145	---	2	2	2	315	315	378
Total	12	12	12	679	638	1,624	343	343	343	23,265	21,067	38,108
Philippeville:												
Europeans	111	111	111	6,956	10,098	13,373	1,480	1,480	1,480	91,944	125,574	222,917
Moslems	20	17	17	1,216	1,691	2,262	136	139	139	9,067	10,147	20,156
Total	131	128	128	8,172	11,789	15,635	1,616	1,619	1,619	101,011	135,721	243,073
Setif:												
Europeans	---	---	---	---	---	---	5	5	---	472	378	---
Moslems	---	---	---	---	---	---	20	37	12	3,307	2,567	1,323
Total	---	---	---	---	---	---	25	42	12	3,779	2,945	1,323
TOTAL	1,294	1,389	1,453	92,190	107,109	159,456	29,062	31,779	33,586	2,348,583	2,654,163	4,280,956

(Continued)

Table 3. - Algeria: Acreage and production of citrus, by kind and by district, 1946-47 to 1948-49 (Continued)

Department, district, and land tenure	Tangerines						TOTAL (Clementines, Grapefruit, Lemons, Oranges and Tangerines)					
	Acreage			Production 1/			Acreage			Production 1/		
	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49	1946-47	1947-48	1948-49
	Acres	Acres	Acres	Boxes	Boxes	Boxes	Acres	Acres	Acres	Boxes	Boxes	Boxes
Department of Algiers												
Algiers:												
Europeans	1,354	1,545	1,483	82,975	127,111	362,184	5,005	6,146	6,025	324,181	459,024	971,241
Moslems	119	185	143	7,905	10,906	32,912	451	507	441	27,255	37,014	73,539
Total	1,473	1,730	1,626	90,880	138,017	395,096	5,456	6,653	6,466	351,436	496,038	1,044,780
Aumale:												
Europeans	2	2	2	54	57	63	19	19	17	274	309	315
Moslems	---	---	5	---	---	189	---	---	29	---	---	1,192
Total	2	2	7	54	57	252	19	19	46	274	309	1,507
Blida:												
Europeans	4,557	4,502	4,359	573,527	419,158	1,007,817	12,564	13,469	13,756	1,292,529	1,054,578	2,332,633
Moslems	489	732	348	50,202	37,289	68,721	1,254	1,735	1,208	114,458	96,457	171,714
Total	5,046	5,234	4,707	623,729	456,447	1,076,538	13,818	15,204	14,964	1,406,987	1,151,035	2,504,347
Medea:												
Europeans	---	---	---	---	---	---	---	---	---	---	---	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	---	---	---	---	---	---	---	---	---
Miliana:												
Europeans	22	22	60	3,987	3,874	4,756	231	259	324	17,008	18,015	28,094
Moslems	10	10	7	1,030	173	504	93	74	54	6,397	3,162	4,850
Total	32	32	67	5,017	4,047	5,260	324	333	378	23,405	21,177	32,944
Orleansville:												
Europeans	94	94	84	4,466	8,346	7,433	2,479	2,355	2,542	151,340	178,953	264,495
Moslems	10	10	7	463	494	598	453	453	359	35,502	16,462	22,455
Total	104	104	91	4,929	8,840	8,031	2,932	2,808	2,901	186,842	195,415	286,950
Tizi-Ouzou:												
Europeans	106	106	116	7,464	6,708	12,062	480	666	580	37,051	51,279	52,482
Moslems	42	42	89	2,709	2,866	7,307	358	295	428	22,466	20,235	30,495
Total	148	148	205	10,173	9,574	19,369	838	961	1,008	59,517	71,514	82,977
Department of Oran												
Mascara:												
Europeans	109	109	109	8,135	11,684	12,409	819	819	865	51,900	101,019	111,857
Moslems	5	2	5	261	104	283	19	16	35	1,676	1,862	2,141
Total	114	111	114	8,396	11,788	12,692	838	835	900	53,576	102,881	113,998
Mostaganem:												
Europeans	277	311	321	14,424	16,267	19,275	3,234	3,220	3,334	214,517	296,263	307,572
Moslems	42	42	42	1,679	1,606	1,921	222	205	268	9,996	14,183	19,236
Total	319	353	363	16,103	17,873	21,196	3,456	3,425	3,602	224,513	310,446	326,808
Oran:												
Europeans	764	1,006	931	37,787	56,406	87,680	8,278	9,500	10,548	675,989	727,376	1,217,833
Moslems	22	24	30	1,968	1,229	1,890	301	305	321	19,725	23,034	22,449
Total	786	1,030	961	39,755	57,635	89,570	8,579	9,805	10,869	695,714	750,410	1,240,282
Sidi-Bel-Abbes:												
Europeans	22	5	2	271	110	472	44	30	49	617	1,203	3,904
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	22	5	2	271	110	472	44	30	49	617	1,203	3,904
Tiaret:												
Europeans	---	---	---	2	2	---	2	---	---	11	5	---
Moslems	---	---	---	---	---	---	---	---	---	---	---	---
Total	---	---	---	2	2	---	2	---	---	11	5	---
Tlemcen:												
Europeans	274	222	222	19,167	22,906	26,991	2,096	1,915	1,900	188,749	210,404	232,014
Moslems	57	55	57	4,403	5,385	6,550	521	514	510	37,335	65,796	67,673
Total	331	277	279	23,570	28,291	33,541	2,617	2,429	2,410	226,084	276,200	299,687
Department of Constantine												
Batna:												
Europeans	---	---	---	---	---	---	7	7	7	287	441	1,259
Moslems	7	5	5	167	696	693	32	40	40	886	2,694	2,529
Total	7	5	5	167	696	693	39	47	47	1,173	3,135	3,788
Bone:												
Europeans	850	855	855	74,418	79,271	87,176	3,721	3,799	3,799	263,431	296,983	341,112
Moslems	22	12	12	2,110	784	1,512	136	108	108	6,596	7,842	10,225
Total	872	867	867	76,528	80,055	88,688	3,857	3,907	3,907	270,027	304,825	351,337
Bougie:												
Europeans	108	116	116	6,173	7,763	12,188	646	660	679	43,871	46,919	65,621
Moslems	30	27	27	1,146	1,644	3,339	601	566	566	29,118	36,193	33,366
Total	138	143	143	7,319	9,407	15,527	1,247	1,226	1,245	72,989	83,112	98,987
Constantine:												
Europeans	22	25	20	1,090	2,290	2,016	101	128	91	3,959	8,794	9,858
Moslems	5	2	7	28	189	724	13	47	37	337	2,868	3,653
Total	27	27	27	1,118	2,479	2,740	114	175	128	4,296	11,662	13,511
Guelma:												
Europeans	57	104	104	5,669	5,401	7,811	423	470	470	29,673	26,835	48,204
Moslems	2	2	2	252	252	283	6	6	6	712	712	661
Total	59	106	106	5,921	5,653	8,094	429	476	476	30,385	27,547	48,865
Philippeville:												
Europeans	1,339	1,364	1,364	89,384	117,020	218,633	3,303	3,320	3,320	203,511	281,451	513,581
Moslems	79	69	69	4,444	5,146	10,425	304	292	292	17,297	21,550	42,827
Total	1,418	1,433	1,433	93,828	122,166	229,058	3,607	3,612	3,612	220,808	303,001	556,408
Setif:												
Europeans	2	2	---	189	236	---	7	7	12	661	614	---
Moslems	10	10	---	756	788	---	30	47	---	4,063	3,355	1,323
Total	12	12	---	945	1,024	---	37	54	12	4,724	3,969	1,323
TOTAL	10,912	11,621	11,006	1,008,705	954,164	2,006,816	48,256	52,000	53,023	3,833,380	4,113,890	7,012,401

1/ Converted to boxes on the following basis: Clementines, 70 pounds per box; grapefruit, 80 pounds per box; lemons, 76 pounds per box; oranges, 70 pounds per box; tangerines, 70 pounds per box.

Source: *Renseignements Statistiques Agricoles*, Algiers, 1948.

Production

The production of citrus in Algeria for 1921-22 through 1950-51 is given in table 4. Prior to World War II oranges and tangerines and clementines were of about equal importance and as late as 1943-44 the total production of tangerines and clementines exceeded that of oranges. In the postwar years this relationship was altered when newly planted orange acreage came into production. Although tangerine and clementine production is above prewar levels, primarily because of improved cultural conditions and availability of fertilizer, and the 1950-51 production of more than 2 million boxes is nearly double the production in most prewar years, the increase in the production of oranges has been much greater. The 1950-51 orange production of more than 5 million boxes was 3 to 4 times the production in most prewar years.

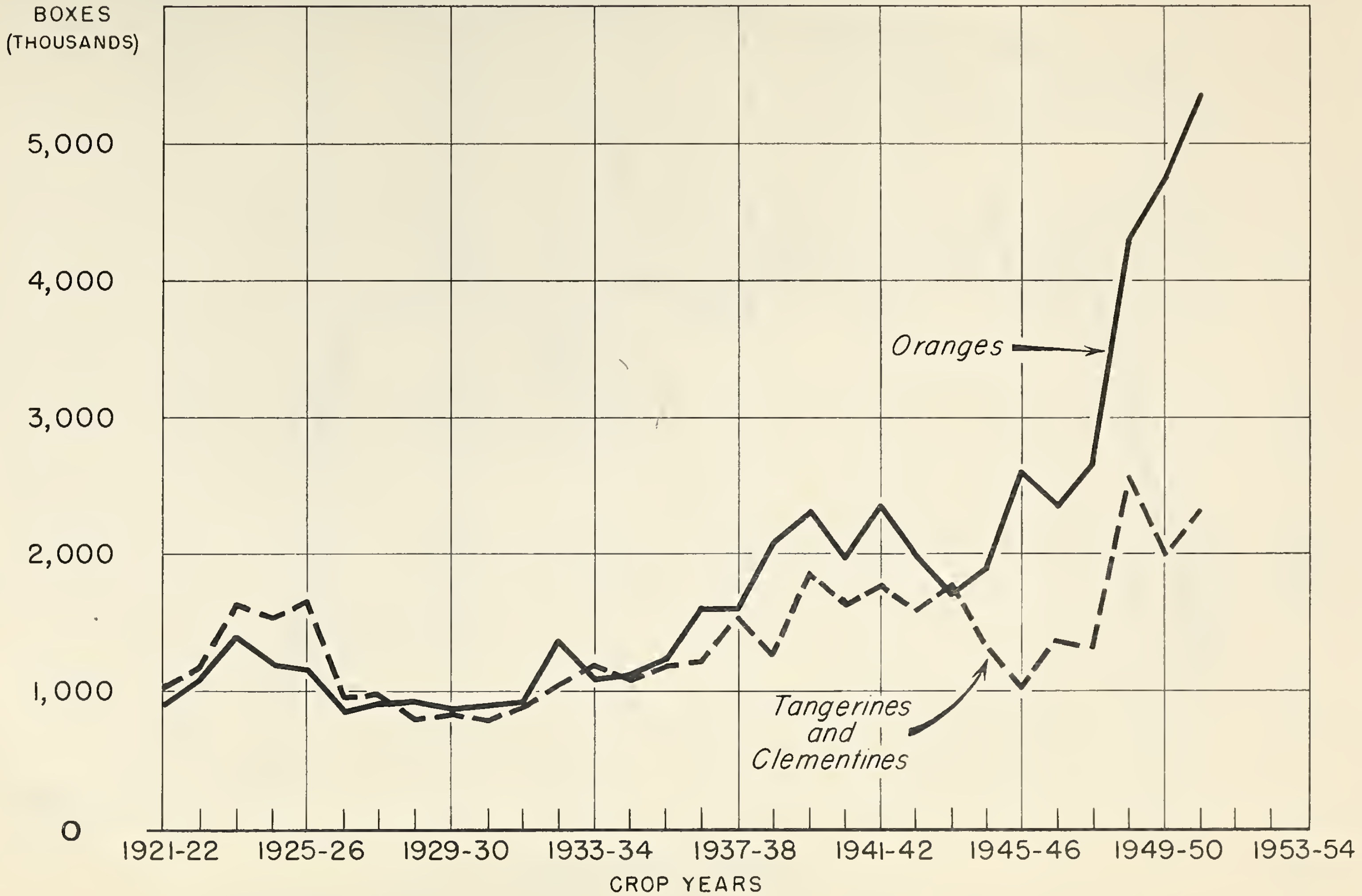
In the future Algeria will be primarily an orange-producing area, and total orange production may increase to about 8 million boxes per year by 1960.

The clementine is an erratic producer, and it is difficult to compare one year's production with another for this reason. Many growers are top-working clementine orchards to other varieties, since they are dissatisfied with clementines, and there is little likelihood that production will increase in the future. The combined production of tangerines and clementines may increase somewhat, but it is unlikely to exceed 3 million boxes in any year in the next 10 years.

The production of lemons follows a different pattern from that of oranges. From 1921 to 1925 over a quarter of a million boxes per year were produced. From 1925 to 1927 production was reduced by more than half, probably because of the destruction of producing acreage by cold weather. The production of lemons remained at about 100,000 boxes a year from 1926 to 1947 when production again increased as newly planted acreage came into bearing. It reached 243,666 boxes in 1949-50. Lemon production will probably be about 200,000 boxes per year in the period to 1960.

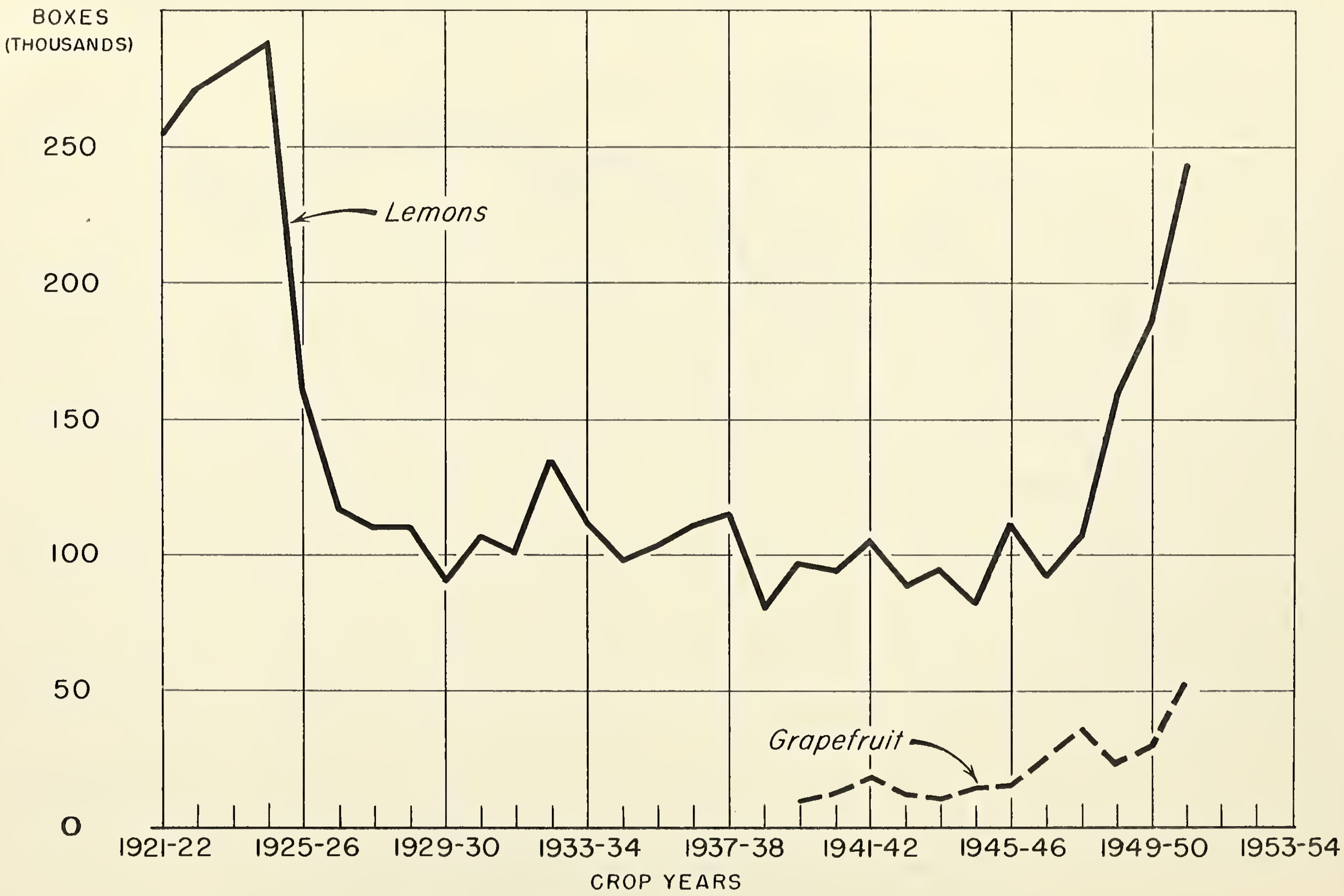
Grapefruit was introduced into Algeria later than the other citrus types. Production has been below 25,000 boxes per year in most years, and grapefruit is likely to continue to be a minor crop. Little new acreage is coming into bearing, and production is unlikely to be much in excess of 50,000 boxes per year in any year prior to 1960.

ALGERIA: PRODUCTION OF ORANGES, TANGERINES AND CLEMENTINES, 1921-22 - 1950-51



U.S. DEPARTMENT OF AGRICULTURE NEG. 1759 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

ALGERIA: PRODUCTION OF LEMONS AND GRAPEFRUIT,
1921-22-1950-51



U. S. DEPARTMENT OF AGRICULTURE NEG. 1762 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Table 4. - Algeria: Citrus production by kind, 1921-22 to 1950-51

Season	Oranges	Tangerines and clementines			Lemons	Grapefruit
		Tangerines	Clementines	Total		
	Boxes	Boxes	Boxes	Boxes	Boxes	Boxes
1921-22.....	909,635	1,017,420		1,017,420	254,655	
1922-23.....	1,073,334	1,162,566		1,162,566	271,773	
1923-24.....	1,397,782	1,633,093		1,633,093	279,032	
1924-25.....	1,207,474	1,537,131		1,537,131	288,054	
1925-26.....	1,168,777	1,646,821		1,646,821	161,188	
1926-27.....	865,619	948,517		948,517	117,409	
1927-28.....	929,057	972,166		972,166	110,771	
1928-29.....	941,286	789,334		789,334	110,992	
1929-30.....	869,949	836,210		836,210	90,579	
1930-31.....	889,047	780,859		780,859	107,590	
1931-32.....	911,817	896,574		896,574	100,584	
1932-33.....	1,358,343	1,041,126		1,041,126	135,546	
1933-34.....	1,073,517	1,173,334		1,173,334	111,838	
1934-35.....	1,104,274	1,086,518		1,086,518	98,530	
1935-36.....	1,220,830	1,197,266		1,197,266	103,252	
1936-37.....	1,594,718	1,208,680		1,208,680	111,604	
1937-38.....	1,623,761	1,528,719		1,528,719	115,577	
1938-39.....	2,066,466	1,248,331		1,248,331	80,898	
1939-40.....	2,306,862	1,844,642		1,844,642	97,307	9,480
1940-41.....	1,949,704	1,621,184		1,621,184	94,418	12,789
1941-42.....	2,329,805	1,260,407	499,717	1,760,124	105,377	18,014
1942-43.....	1,968,676	1,175,754	402,872	1,578,626	89,008	12,856
1943-44.....	1,696,483	1,300,207	452,015	1,752,222	94,972	10,697
1944-45.....	1,899,779	944,369	376,526	1,320,895	82,113	14,514
1945-46.....	2,605,550	573,841	449,474	1,023,315	112,168	15,330
1946-47.....	2,348,583	1,008,705	358,377	1,367,082	92,187	25,532
1947-48.....	2,654,162	954,164	361,907	1,316,071	107,109	36,547
1948-49.....	4,280,956	2,006,816	541,418	2,548,234	159,456	23,755
1949-50.....	4,727,354	1,445,588	551,150	1,996,738	186,294	29,459
1950-51.....	5,360,328	1,618,807	692,874	2,311,681	243,666	52,359

Source: Official sources and consul reports.

Citrus Districts

The citrus districts of Algeria are widely scattered along the coastal belt facing the Mediterranean for a distance of 400 miles from Oran to Philippeville. These districts are all connected by rail. There are small plantings of citrus in the more mountainous areas and in oases in the desert area, but these are only of local importance.

Department of Oran. Old closely-planted citrus orchards are found near the city of Oran, and in the nearby area at Mostaganem. The third most important area in this department is Tlemcen. Many of the citrus orchards in this area consist of clementines which originated near Oran. Because of its proximity to Spanish Morocco and the fact that many Spanish immigrants came to this region, the culture has been influenced by Spanish methods.

Department of Algiers. The plantings are of two types: older closely-planted groves, mostly near Blida and Boufarik, some of which were established in 1895; and newer plantings made along modern lines. The most important citrus plantings in Algeria are found on the coastal plains in the vicinity of the city of Algiers, primarily in the district around Blida. Another important citrus area lies inland and east of Oran at Orleansville. Unlike the plantings around Oran, however, the citrus orchards in this new area are planted along modern lines and use mechanical cultivation. A new citrus area is located inland from Algiers near Affreville.

Department of Constantine. Newer type plantings are found at Bone, Bougie, and Philippeville. These are all coastal plantings in valleys near the sea, and most of the orchards are adjacent to watercourses. There is a small citrus area somewhat inland and east of Algiers at Constantine.

Topography, Climate, and Soils

Topography

Algeria is similar to California in that the intensive agriculture is found in a coastal belt, approximately 50 miles deep. This region is cooler than the interior, receives reasonable rainfall, and is supplied by gravity irrigation water from mountain ranges which separate this area from the more arid interior. Across the mountains to the interior is a high, semi-arid plateau region which is devoted to cereal crops. Beyond this belt for 20 to 30 miles is the arid desert region used primarily as grazing land for sheep, goats, and beasts of burden, such as camels.

The commercial plantings of citrus occur in the irrigated coastal areas. Small plantings of citrus are also located in the more mountainous area, and a few trees may be found in oases, even deep in the Sahara. These small plantings have commercial value, but the fruit is disposed of locally, primarily to the native population. Many of these plantings are of seedling trees or of local varieties. Some of these plantings occur at an elevation of 1,500 feet in mixed garden plantings of citrus, deciduous fruit, almonds, and olives.

There is considerable climatic difference between the lower coastal region and the higher areas toward the interior. Navel oranges in the coastal area are full ripe in February; however, fruit raised in small plantings toward the interior is still quite sour at that time, and would not be considered mature fruit for shipment by United States standards.

Climate

There are two distinct climatic zones in the citrus-producing areas of Algeria. The districts in the coastal region, such as Algiers, Oran, Philippeville, Bougie, and Bone, have a humid summer climate and a higher winter and spring rainfall than the citrus areas further inland. Because of the humidity, the monthly range of temperatures is not so extreme as in more arid regions, and there is less variation in temperature from day to night. The rainfall averages about 20 inches a year, but much heavier rainfall is sometimes recorded. It is reported that every decade or so in the past extremely heavy rainfall has caused severe floods in the coastal region. Since a high range of mountains, in many places over 6,000 feet, lies within 50 miles of the coast, the runoff is very rapid.

Since the last flood, the population of Algeria has increased, resulting in a further denuding of the watershed as the wood-burning native population seeks firewood. This may have serious consequences if Algeria ever again experiences a period of extremely high rainfall.

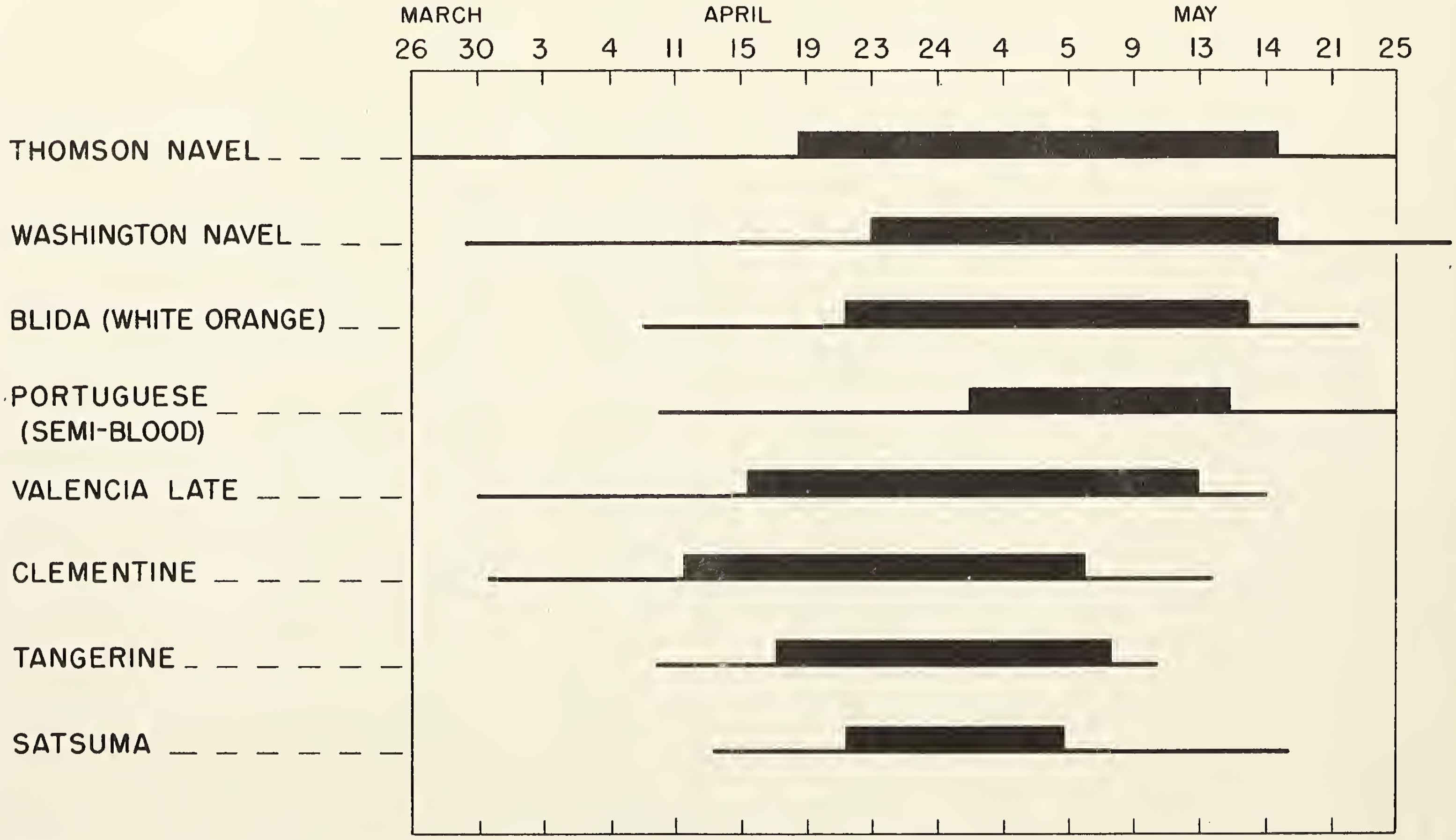
The period of highest rainfall is from September through March; however, considerable rainfall may occur in the spring months of April, and May.

The effect of the season on citrus in the coastal region is shown by the time of bloom of several varieties of oranges at the experiment station at Boufarik near Algiers. (See chart on page 20.)

The second climatic zone is that of the citrus areas some distance inland and away from the coastal influence. These are represented by Voltaire, inland from Algiers, and Orleansville near Oran. These areas are more arid than the coastal regions and have an annual rainfall that averages about 15 inches a year. The period of highest rainfall--from September through March--is about the same as in the coastal area. However, the spring rainfall is lighter, and the summers are more arid. Because of the lower humidity the temperature range is more extreme than in the coastal area, and the temperature differences between day and night are greater.

Wind is an important climatic factor in Algeria, and citrus plantings are surrounded with windbreaks. In the summer, particularly the late summer, the desert sirocco winds blow from the Sahara toward the Mediterranean. These wind storms seldom exceed 3 days in duration, but they may do severe damage. The hot, dry winds may burn both citrus leaves and fruit, regardless of soil moisture.

TIME OF BLOOM OF SEVERAL VARIETIES OF ORANGES AS OBSERVED AT THE EXPERIMENTAL STATION AT BOUFARIK, ALGERIA, 1941



FROM: COMPTES RENDUS DE L'EXPERIMENTATION FRUITIERE EN ALGÉRIE, ANNÉE 1941, PAGE 6.

U. S. DEPARTMENT OF AGRICULTURE NEG. 1773 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Frost, while not frequent, can occur in Algeria. In the first week of February 1949, a frost struck the citrus districts near Algiers, damaging some fruit raised on the valley floor, as in the area near Boufarik. Frozen oranges and slight foliage damage were observed at that time. Since the high mountain ranges inland from the coast are snow-covered in winter, and skiing is a winter sport not far from Algiers, the possibility of frost is apparent. Frost protection is not practiced in Algerian citrus groves.

Table 5. - Algeria: Minimum and maximum temperatures by month at Algiers and Orleansville, 1937

Month	Algiers		Orleansville	
	Minimum F.	Maximum F.	Minimum F.	Maximum F.
January	44.0	76.0	33.8	72.0
February	48.7	78.0	34.0	71.0
March	46.6	76.0	38.0	87.0
April	48.0	78.0	40.5	89.0
May	52.0	93.2	48.7	97.0
June	62.6	90.0	58.0	102.0
July	66.2	102.5	63.0	112.0
August	69.0	97.0	62.6	110.0
September	59.0	90.0	54.0	98.6
October	59.5	92.0	50.0	88.0
November	52.0	83.0	42.8	77.0
December	39.0	73.6	32.0	68.0

Source: Official sources.

Table 6. - Algeria: Rainfall by month at Algiers and Orleansville, 1937

Month	Algiers	Orleansville
	Inches	Inches
January	0.8	1.4
February	0.5	0.3
March	1.9	1.1
April	1.6	0.9
May	1.0	0.8
June	0.04	0.0
July	0.0	0.0
August	0.008	0.0
September	1.8	0.04
October	1.2	1.1
November	2.0	1.6
December	8.5	7.1
Total	19.3	14.3

Source: Official sources.

The nature of the drought and frost hazard in Algeria is demonstrated by the production records of lemons. It will be noted that the production of this fruit prior to 1926 was approximately double that of recent years. A severe sirocco wind occurred on July 4, 1924, and the production of vegetables, grapes, and citrus was damaged by drought.

In 1925, fruit trees in the mountain districts were damaged by frost in the spring, small olives were destroyed by a violent snow storm, and artichokes were damaged by cold in the winter. The records of temperature at that time indicate that the January-March period of 1925 was exceptionally cold in Algeria. At Orleansville a minimum temperature of 1.8° C. (28.7° F.) was experienced in the city, and on the coast at Constantine, normally a warm zone, a minimum of 3.5° C. (25.7° F.). In citrus districts in Algeria, temperatures during January ranged from -3.5° C. to 0° C. (25.7° to 32° F.). These temperature readings were taken in cities, and the temperatures in citrus areas probably were even lower.

Soils

All of the citrus areas visited in Algeria, including those of Oran and the inland areas near Affreville and in the vicinity of Algiers, have very heavy soils with high percentages of clay. Only a very few orchards have what would be considered a sandy loam soil. In some places, the soil is dark brown, but as a rule it ranges from a light to deep red in color.

A special soil type is found in a very limited citrus area north of Algiers in the hill region where a new lemon district is developing. On those hills the soil is a very light sandy type with excellent drainage.

The heavy soils do not have good drainage, and excess moisture in the soil was responsible for the root damage seen in some orchards. In areas near Blida the water table in winter is occasionally only 5 feet below the surface. Some soils are usable for citrus only after the installation of drainage tiles.

In the winter after heavy rainfall, water stands in the orchards since it penetrates the soil very slowly. In the summer, irrigation water has to be applied by furrow because of the heaviness of the soil. When the soil is wet it is very slick, and when it dries it cracks.

Cultural Practices

Even in areas of major commercial citrus plantings, the areas of production are scattered. It is characteristic that each planting is surrounded by a windbreak composed principally of Italian cypress. The plantings may be roughly divided into two classes, according to the age of the grove.

In older groves, where the planting distance may be as close as 10 or 12 feet, the ground is entirely shaded, and the fruit-producing area of the tree is confined to the top exposed to the sun. In these older groves the skirts are pruned very high, and the lowest branch may be 5 or 6 feet from the ground. Even in these groves of 25 or more years of age the trees are still quite small, the largest not over 12 feet tall. These old groves are usually cultivated by a horse-drawn plow, and the area near the tree is worked by hand. Spraying may be done with small hand pumps similar to those used in gardens. At Oran, growers stated that crops average between 4 and 6 metric tons of fruit per hectare per year (about 3,570 to 5,350 pounds per acre).

The newer groves with greater planting distances are cultivated entirely by horse- and tractor-drawn implements; many of the orange trees are unpruned, and power sprayers are in use. However, hand agitation is practiced, resulting in an uneven application of spray material. In one grove visited, lightly pruned trees were planted 378 to the hectare (about 150 per acre), and average annual production was said to be approximately 18 metric tons per hectare (about 16,000 pounds per acre).

In Morocco, groves planted with only 178 trees to the hectare (about 70 per acre) will give approximately the same production. Therefore, the number of trees per hectare cannot be used as a guide to estimating potential production.

Cultivation

In Algerian citrus groves cultivation is accomplished by both horse-drawn and mechanical means. It was observed, however, that tractors are the primary means of cultivation in European-operated groves. Due to the heavy soil, crawler tractors are used almost exclusively, and tillage is accomplished by the use of discs.

Because of the quantity of clay in the soil the growers practice subsoiling down row middles and between the windbreaks and the first row of trees in groves where the planting distance is ample.

The land on which field crops are grown is plowed with giant plows which are set approximately 3 feet deep. In the groves, growers also seem to prefer deep cultivation, and irrigation furrows are made at least a foot deep in most groves. It was observed that this deep tillage caused some root damage, particularly at the end of rows where turns were made.

Fertilization

In commercial citrus groves, rather heavy applications of fertilizers are made. Common practice is to use sulfate of ammonia and a complete mix formula of 6-6-8. A representative commercial application would be 357 pounds of sulfate of ammonia per acre and 892 pounds of the complete mix. Sulfate of ammonia is an imported product, but the complete fertilizers containing superphosphate are produced locally.

In winter, cover crops are raised in most orchards.

From observations of the groves, it would seem that the present fertilization practice is quite adequate. Some leaf symptoms of minor element deficiency were seen, and the use of zinc would probably be helpful in most groves.

Water Supplies

Irrigation water for the coastal area is obtained partially by gravity flow, and partially by pumping. During periods of rainfall, the runoff is very rapid since the streams may drop as much as 1,200 feet in a distance of 50 miles.

In the area around Boufarik and Blida, high water tables occur, and groves may be found planted in areas where the winter water table comes within 3 to 5 feet of the surface. In such areas, summer irrigation may be easily accomplished by pumping with centrifugal pumps placed in the wide-mouthed wells near the water surface. Pumping is performed primarily by the use of electric power.

In February 1949, considerable rainfall occurred in the area surrounding Algiers. Following heavy rains all streams are very muddy, and agricultural land in the mountain and hill areas is showing signs of erosion. Farming practices which would control erosion do not appear to be in general use. Algeria supports a very large native population which used wood as its primary fuel, and the constant cutting of wood is, no doubt, a part of the problem of erosion control. Hillsides, in places, are denuded of readily available wood, and pack trains of donkeys carrying fuel supplies are a common sight.

Recently, in Algerian citrus districts, water supplies have been ample. This is not always true, and periods of drought have been experienced which seriously damaged both vineyards and citrus. The erosion now taking place may have a future influence upon the water tables of the coastal plain in Algeria.

Some new dams being constructed with assistance from ECA funds will bring new land under irrigation, but many new wells installed in the last 5 years will be a further drain on underground water supplies when a drought next occurs.

Irrigation

Where irrigation water is obtained by pumping, deep stone-walled cisterns are dug, and the water lift as observed is approximately 30 feet in most citrus areas. A furrow type of irrigation is also practiced, some groves using as few as two furrows in a row and others as many as four. Most furrows are at least a foot deep, and damage to tree roots was observed.

Irrigation is one of the big problems of Morocco and Algeria. Irrigated culture is comparatively new, and present practices need improvement. Soil tubes are not used, and in the heavy clay soils some groves seemed damaged by overirrigation. Water is applied through furrows over long periods of time, and a 30-hour water run for irrigation is not unusual. The heavy soil and high water table present a problem in the control of fungus diseases of both the tree and roots.

One grower near Algiers is using large sprinklers of the type seen on golf courses. This has apparently been quite successful, and a grove of 5-year-old Hamlin oranges produced a crop of 5 metric tons per heotare (approximately 4,460 pounds per acre).

Root Stocks

In propagating trees, it is the general practice to bud quite high, and the average bud union is approximately 2 feet from the ground. Almost the entire citrus acreage of Algeria is budded on sour orange stock. A few plantings of clementines, however, are budded on trifoliate orange stock, which seems especially suited to the clementine orange.

Algerian citrus growers are aware of the danger of using sour root stock which is susceptible to an infection of quick decline. The experiment station is working on this problem, attempting to find varieties of root stock which are resistant to quick decline and yet suitable to Algerian soils.

A change in root stocks in Algeria presents a serious problem since the heavy soils would seem to preclude the use of most commercial sweet orange root stocks.

Nurseries

Citrus nursery stock in Algeria is produced by commercial nurseries. There are a great number of these located in the vicinity of Algiers, and it would seem likely that citrus plantings will be increased in the next few years.

In 1949, the commercial price of a budded orange tree suitable for orchard planting was 300 francs ($0.86), which Algerian orange growers considered to be very high. This high price was due to the great demand for trees, and it is estimated by growers that the price will be considerably lower in a few years when the immediate demand has been met.

The trees observed were well-grown. Like other phases of the Algeria citrus industry, nurseries are controlled by Government decree, and this should be of great assistance in developing a sound industry in Algeria from disease-free trees with good production records.

Planting Distance

In the older Algerian citrus orchards it is common to see trees planted very closely together. At one time, planting distances of 10 by 10 feet to 12 by 12 feet were common. These closely-planted groves are difficult to work; they must be cultivated primarily by hand since it is impossible to get any type of mechanical tillage implements between the trees.

Today the recommended practice, which observation indicates is being followed, is to plant most orange trees at the rate of 175 to 200 to the hectare (71 to 81 trees per acre). Tangerines are planted somewhat more closely, and the recommended practice is to plant 400 of these smaller trees to the hectare (162 trees per acre). The number of trees planted to the acre depends somewhat on the variety. Lemons are planted from 125 to 175 to the hectare (51 to 71 per acre), and approximately the same planting distances are used for grapefruit and the Valencia Late. The Portuguese, Jaffa, and Verna orange trees are somewhat smaller and may be planted from 200 to 275 to the hectare (81 to 111 per acre).

Citrus Diseases

The groves observed in Algeria appeared to be remarkably free from diseases other than gummosis and root rot. These diseases are most prevalent in the heaviest soils and particularly where there is poor root drainage or a high water table.

The following diseases exist in Algeria; some were observed, and others have been reported in official publications.

Armillaria. Official publications indicate that this fungus is present in Algeria and other parts of North Africa and is particularly damaging in heavy soils where there is poor drainage; however, no infection was observed in orchards visited.

Psorosis. This virus disease is found in Algeria and other areas of North Africa, primarily on the navel orange. It was probably introduced into the orchards by trees obtained from Spain or other areas where the disease is present. Psorosis was observed, even in the newest commercial plantings, and leaf symptoms may also be found on nursery stock. In the best orchards, psorosis is treated by scraping, and the trunks are painted with a copper sulfate solution.

Quick decline. Growers state that no quick decline is present in Algeria, and no evidence of it was observed.

Mal secco. The humid climate of the coastal area may be favorable to the development of mal secco, the tree-killing fungus disease, which has done so much damage in Sicily and Italy. No mal secco was seen in 1949 and perhaps none exists today, but official publications report that mal secco infections were found on bitter orange trees in Algeria in 1938, and a more intensive inspection of citrus orchards revealed that a number of minor infections existed in Algeria at that time.

Anthracnose. This disease is active in the more humid areas near the coast, but the dry interior regions of Algeria and Morocco are not bothered to any extent by this disease. Disfiguration of both lemons and oranges caused by anthracnose was observed.

Gummosis. Due to the heavy soils and high water table, gummosis is present in most groves. The light color of leaves and the thin foliage indicate that there must be some sour rot on roots. From observation and reports, this is the most important citrus disease in North Africa. Sour orange root stock is used extensively to prevent damage by this disease. Nursery trees are usually budded quite high as a protective measure against gummosis. The painting of the trunks with either whitewash or a Bordeaux solution is a common practice. In the better orchards, large pruning cuts were painted and seemed to be in good condition.

The majority of Algerian orange groves are young, and tree replacement is not yet a serious problem; however, it was noted that damaged trees are not promptly removed. This is particularly true of the old plantings.

It is a traditional practice in Africa to place rows of trimmings from thorn bushes around small orchards and gardens to keep out animals. Some gardens are protected in a similar manner by closely planted hedges of seedling orange trees, the thorns of which seem to serve as a fence. These hedgerows would seem to be excellent host plants for both citrus diseases and pests.

Government regulations control the marketing of citrus and the sale of nursery trees, and a control of citrus disease is also being attempted. The regulations provide that scion stock shall only be taken from psorosis-free trees. Under such regulations it seems possible that the control of such diseases may be obtained in the future.

Pest Control

In small citrus plantings in the coastal and hill areas, practically no pest control is practiced. Since the plantings are small and scattered, there is probably an opportunity for some biological control. In some years which are unfavorable to the development of scales, no pest control at all may be necessary, even in commercial groves.

In 1944 there was still some difficulty in obtaining sufficient supplies of oil for spraying purposes, but an American firm is now producing this item in France. Spray-material dealers say that it is also very difficult to obtain nicotine sulfate for use as a control measure against aphids which cause some damage to trees in the spring.

Black, California red, and purple scale were all observed. The Mediterranean fruit fly damages fruit, primarily tangerines, in the fall months before the first rains. Growers state that the thicker-skinned, later varieties do not seem to be bothered by this pest.

The following common scale pests are listed in *Annuaire des Agrumes Nord-Africaines* as being found in Algerian citrus orchards:

- *Chrysomphalus aonidum*
- *Chrysomphalus dictyospermi*
- *Parlatoria zizyphi*
- *Parlatoria* Pergandei
- *Lepidosaphes* Gloweri
- *Lepidosaphes citricola*
- *Saissetia oleae*
- *Coccus hesperidum*
- *Pseudococcus citri*
- *Icerya* Purchasi

In 1948, commercial sprayer operators charged 25 francs per tree for spraying, which price included both the cost of materials and the application. Costs are believed to have increased since that time.

Scale pests are controlled by fumigation in winter and by oil sprays in the summer and fall. Oil spray was observed being used in August, with a 2-percent white oil solution the most common dosage. Sprays are applied in various ways. In some older orchards, hand barrel pumps or garden spray apparatus is used to apply the spray material in a fine mist under very low pressure. In other groves, power-driven pumps are used with two men applying the spray from the ground with a multinozzle "brush spray" approximately 8 inches wide. The tank agitation is by hand, and towers are not used. "Nurse rigs" are used, usually consisting of wooden tanks mounted on a horse-drawn two-wheel cart which brings water and mixed material to the applying rig in the orchard.

The spraying observed was not satisfactory. Even on power sprayers, the pressure was too low to achieve full coverage of all leaves and twigs, and dry areas were observed on each sprayed tree. Since the material is agitated by hand, the resulting mixture is not always even, and trees are sometimes burned by excessive oil.

Pruning

Two distinct types of pruning are practiced in Algeria. In the older groves, where the trees are planted closely together, the lower limbs are removed to a height of 5 or 6 feet from the ground, and the tops of the trees are heavily pruned. In this manner the trees are kept quite small. The trees in the old tangerine and clementine orchards are more heavily pruned than the orange trees.

In some of the newer orange groves the more modern cultural practice is being followed. Here, where the trees are planted 20 to 25 feet apart, very little if any pruning is being carried on. One grower in the vicinity of Algiers is conducting a pruning experiment. He is leaving one section of an orange grove unpruned, and this will be compared with another section where the usual pruning practice is being carried on. When the fruit is harvested, the quality, size, and quantity from the two sections will be compared. In this manner it should be possible in a few years to determine the merit, if any, of the pruning practices.

The first report on this experiment is given in table 7.

Table 7. - Algeria: Production of Cadenera oranges in a pruned and unpruned orchard, 1949-50

Size of fruit	231 pruned trees		240 unpruned trees	
	Number of boxes	Percentage of total	Number of boxes	Percentage of total
150	4	1.24	4	1.49
176	22	6.81	13	4.85
200	16	4.96	10	3.73
216	74	22.91	42	15.67
224	91	28.17	68	25.38
252	116	35.91	131	48.88
Total	323	100.00	268	100.00
	Average per tree			
	1.40		1.12	

Source: This information was supplied by Andre Klene Fils of Voltaire, Algeria.

The pruned trees produced more fruit per tree and somewhat larger fruit than did the unpruned trees, but these results should not be considered as conclusive. The unpruned trees had been pruned at one time and when pruning was stopped for the experiment a heavy sucker growth took place in the center of the tree. This growth might tend to reduce fruit production. It would require several years for the unpruned trees to establish the normal balance of foliage and structure necessary to evaluate the experiment.

Growers claim that it is necessary to prune tangerine trees heavily in order to obtain fruit of commercial size. A few unpruned tangerine trees observed in gardens were large, well-shaped trees similar to those seen in Florida and California orchards. These trees did not seem to have quite as large fruit as the heavily pruned trees, but an equally good set of fruit was evident.

In the orchards where the orange trees are pruned, the skirts are raised at least 3 to 4 feet from the ground, and the interior of the tree is opened up so that sunlight may reach the center of the tree. Enough of the foliage is removed so that it is usually possible to see through most of the trees in the orchards. It is possible that the pruning practice may contribute to orchard disease control. Since the opening of the center of the tree permits more light to reach the trunks and branches, this may have a tendency to reduce the damage from gummosis and other fungus disease which are stimulated by moisture.

A distinct Spanish influence is found in the vicinity of Oran. In the past it was customary for Spaniards to come to Oran for the harvest of fruit, and there is a considerable number of Spanish people now living in the vicinity of Oran. When they engaged in citrus culture they, of course, brought the cultural methods with which they were familiar. In this way the pruning practices of Spain were probably brought to Algeria. Since Oran is one of the oldest citrus districts, it is likely that the orchards developed in other areas of Algeria followed the practices which had been brought there.

From casual observations of the citrus orchards in Algeria, it would seem that the pruning of orange trees is excessive.

Experiment Station

Under the direction of the Government of Algeria, an experiment station in citrus culture is maintained at Boufarik, which is some 25 miles inland from the city of Algiers. Extensive experimentation is being carried on with citrus varieties suitable for culture in Algeria and also with general culture problems of fertilization, irrigation, and pest control. In a department of the experiment station an investigation is also being carried out regarding the processing of citrus byproducts. Experiments in the canning of various citrus juices and blends in citrus juices are being made. The experiment station is apparently competently staffed, and this organization has produced many publications of value to Algerian citrus growers on various subjects of citrus culture. The experiment station should make valuable contributions to the guidance of Algerian citrus growers. (See appendix II for a list of the citrus varieties which are planted at the experiment station.)

The citrus grower of Algeria and Morocco obtains much more assistance from government experiment stations than does the citrus grower of Tunisia, Spain, or Italy. The existence of competent experimental workers in both Morocco and Algeria should lead to the development of higher standards of citrus culture.

Citrus Varieties

As the orange acreage in Algeria has increased, emphasis has been on planting navel and blood varieties. This is illustrated by table 8, which indicates the percentage of each orange variety sold in Algeria in the season 1945-46.

Table 8. - Algeria: Percentages of total nursery orange tree sales of each variety, 1945-46

Variety	Percentage of total sales
Washington Navel	26.5
Portuguese (semi-blood)	21.0
Double-fine amelioree (blood)	17.8
Valencia Late	12.4
Thomson Navel	9.5
Double-fine (blood)	8.8

Source: Annuaire des Agrumes Nord-Africaines, 1948, page 70.

There is considerable acreage of local varieties, few of which are exported to European markets. As a general rule, the local varieties are not of as good quality as the bloods, Valencias, and navels.

The quality of the best citrus is equal to anything produced in any area of the United States. Both the interior and exterior quality of the navels, bloods, Portuguese semi-bloods, and Valencias are exceptional. The fruit it highly colored--more so than any United States fruit. The blood and semi-blood oranges are of exceptional quality, and all the export varieties are of the type which is suitable to the European market in that they are easily peeled and may be eaten out of hand.

The lemon and pomelo, or grapefruit, are very minor crops in Algeria. The grapefruit does not find a ready market in Europe, and the consumption of lemons in Algeria is rather small, in spite of the country's warm climate. In some inland districts lemon trees are being top-worked to Washington Navels and other orange varieties. It is interesting to note that this top-working is accomplished by grafting, even on tree trunks 3 and 4 inches in diameter.

Table 9. - Algeria: Commercial varieties of oranges

Maturity	Variety	Commercial name
Early varieties	Thomson Navel Washington Navel	Navels
	Hamlin 1/ Cadenera 1/ Viciedo 2/	White (nonblood) seedless
Midseason varieties	Maltese Jaffa (Shamouti) Zeg-zel 2/	White (nonblood) seedless
	Portuguese Double-fine Washington, sanguine	Blood seedless
Late varieties	Valencia Late Verna (Berna)	Late seedless
Various times of maturity	Other nonblood varieties	Common white (nonblood)
	Other blood varieties	Common bloods

1/ Experimental varieties.

2/ Varieties planted in Morocco on a small scale.

Source: H. Rebour, Les Agrumes en Afrique du Nord, Algiers, 1945, p. 83.

Oranges

The following description of North African orange varieties is a translation from the French.2/ These descriptions should be enlightening as to the commercial orange varieties of Spain, as well as of North Africa, since many of the varieties are the same.

I. Navel Oranges

Characterized by the presence of a navel clearly marked at the blossom end.

Thomson Navel. (a) Form: Round, slightly oval, navel somewhat protruding, weight 150 to 200 grams. (b) Skin: Fine, becomes thinner from the stem to the navel, very smooth and glossy, especially at the base of the fruit. (c) Seeds: Generally seedless. (d) Pulp: Dry, fibrous, highly colored, very slightly tart, large juice sacs. (e) Ripens: November 15. (f) Observations: Not to be confused with Golden Buckeye (earlier) and Golden Nuggett (later), varieties to be kept out of, not reserved for, exportation.

Washington Navel. (a) Form: Round or slightly oval and sometimes flattened at the ends, navel inward, some puckering around the stem, weight 180 to 250 grams. (b) Skin: Firm (permitting preservation until April), wrinkled, of regular thickness over all parts of the fruit. Orange color, darker than the preceding variety. (c) Seeds: Generally seedless. (d) Pulp: Crisp, well colored, juicy, slightly tart (more than Thomson). (e) Ripens: Last of November.

The only advantage of the Thomson Navel is that it ripens 8 to 15 days earlier than the Washington Navel.

The Thomson has had the favor of Algerian planters while the Washington was adopted as the preference in Morocco. This anomaly was explained in the following manner: The cultivation of the navel orange is rather old in Algeria. The type of Washington which came to Algeria when the two varieties were introduced by Dr. Trabut, was an unfortunate mutation. The forms which have been newly introduced are clearly superior from all points of view. It must not be forgotten that the selling of selected grafts was not organized in California until 1917, a long time after the navel was introduced into Algeria.

The planters therefore chose the Thomson, which has at least the advantage of earliness. But the qualities of the fruit are clearly inferior: less juice, a certain flatness, a coarse flesh which has caused it to be called "wood orange" in the United States, a lighter density; it is now abandoned in favor of the Washington Navel. Another defect of the Thomson, which ought definitely to condemn it, is its sensitivity to psorosis, a virus disease, the effects of which manifest themselves only when the tree is 8 to 10 years old. A great number of Algerian plantings of the Thomson carry traces of psorosis, a disease which is able to reduce production considerably.

2/ H. Rebour, Les Agrumes en Afrique du Nord, Algiers, 1945, p. 85.

The Washington Navel is the only winter variety cultivated in California. The Moroccans, basing their selection on this fact and on the similarity of climate, adopted it at the onset and cultivate it exclusively. Their system has given excellent results. From repeated introductions from various sources, they were soon able to have pure types; this was all the more easy because the selection was at its highest point of perfection in California at that time.

The Washington Navel has several qualities of prime importance. It bears rapidly, abundantly, and punctually. Its fruit may be transported easily and keeps a sufficiently long time - until March. It is claimed to be less sensitive to "June drop" than the Portuguese. Nevertheless, the 1942 season has weakened the foregoing statements.

The Thomson and Washington Navel have yielded numerous mutations. None of them has been able to supplant the Washington.

The Thomson is ripe, in average soil, toward November 15; the Washington Navel ripens at the end of the same month. It can therefore supply export markets before Christmas and New Year's Day when consumption is particularly high. Its picking can be postponed to January or February, a time when the fruit attains all its flavorsome qualities.

II. Seedless White (nonblood) Oranges

Varieties in this group may have four or five seeds. They mature from November to March.

Hamlin. (a) Form: Round, slightly flattened at the ends. Average weight 140 grams. (b) Skin: Thin, resistant and firm, smooth, glossy, fine grain, red-orange color, most highly colored of the nonblood oranges. (c) Seeds: None to five, round. (d) Pulp: Highly colored early, very juicy, pronounced acidity. (e) Ripens: First of December.

This beautiful orange has been recommended in place of the Thomson because of its earliness. Unfortunately its early maturity seems to have been overestimated becuase of the Hamlin is very acid, and it is scarcely possible to consume it before December 1.

Cadenera.3/ - Synonyms: Cadena fine, Orero, Sin Hueso, Pajerito, Valencia seedless, Cornice, Cadenera Du Crocq. (a) Form: Round, sometimes slightly oval. Weight 110 to 180 grams. (b) Skin: Yellow-orange, grainy (more than Hamlin, less than Valencia). (c) Pulp: Colors early, very fine-textured, extremely juicy, tart. (d) Seeds: Generally seedless, sometimes up to three seeds. (e) Ripens: Third week in December; capable of being kept much later on the tree.

The Cadenera was introduced because it was supposed to mature very early, but it does not seem to ripen as soon as it was hoped, especially on the heavy Algerian soil. This variety will not have all the qualities attributed to it unless it is planted in sand which gives it a certain earliness.

3/ Cadenera is the major nonblood orange type of Spain.

The synonyms of Cadenera are very numerous, and some less desirable varieties have similar names. It is an extremely juicy orange--with the Valencia Late, one of the juiciest.

Jaffa. - Synonyms: Chami, Chamouti, Shamouti. (a) Form: Oblong, rarely round, cavity very marked at the base of the stem. Average weight 220 grams. (b) Skin: Thick, rather coarse grain, especially near the stem. Color yellow orange. (c) Seeds: Generally seedless. (d) Pulp: Very colorful, firm, medium juicy. (e) Ripens: Last of January, February. (f) Observations: Holds up very well in transport.

The low productivity in Algeria of this variety made it necessary to abandon it. It is highly cultivated in Palestine, where it is grafted on the sweet lime.

There exists in Tunisia under the name of Jaffa a pear-shaped, semi-blood orange, of excellent quality, but it is not very productive. It has nothing in common with the Jaffa of Algeria and Morocco.

Maltese White. - Synonyms: Little Jaffa, Lautrec, Portugal white. (a) Form: Regularly oval. Average weight 110 to 180 grams. (b) Skin: More or less resistant (according to the hygroscopic state of the soil), medium fine. Color yellow orange. (c) Seeds: Sometimes one or three seeds. (d) Pulp: Medium-colored, juicy at maturity, very savory. (e) Ripens: End of January, does not stay on the tree very well. (f) Observations: Keeps badly during transport.

This orange greatly resembles the Jaffa in appearance, but its qualities are rather different. While the Jaffa travels very well, the white Maltese cannot be shipped long distances. It falls very easily from the tree when it is ripe. It is sensitive to cold. On the other hand its taste qualities are clearly superior. This variety is cultivated on limited acreage in Tunisia, in Algeria near Bone and Philippeville, and in Morocco. It is not considered important.

III. Seedless Blood Oranges

The skin and pulp of the varieties in this group may be more or less streaked with blood particles. May have as many as 4 or 5 seeds.

Portuguese. - Synonyms: Maltese blood, Maltese semi-blood (in Tunisia), Portuguese semi-blood, Portuguese blood. (a) Form: Generally oval, but rather often round. Average weight 100 to 180 grams. (b) Skin: More or less smooth, lacking firmness. Color red orange passing to deep red at maturity. (c) Seeds: 0 to 3. (d) Pulp: Very juicy, acid, highly perfumed, very colorful by the first of January, blood streaks on the bottom one-third from January 15 to January 20. Divisions very fine. Empty placenta slightly pronounced. (e) Ripens: Eatable at the end of January. Ripe in February. In light soil, harvest can be put off until March.

Sometimes two varieties are distinguished: Portuguese semi-blood and Maltese semi-blood. In the pure state, the two types have a very characteristic appearance. The leaves and branches of the first are more erect than those of the second. But more often one finds intermediate strains, and it is very difficult to class them with one category or the other. The difficulty of classifying is still greater with respect to the fruits. These will more often be oval in the Maltese, but here too the variations are numerous.

It is certain that several forms exist, and it would be interesting to select and study them in different environments. At the moment we still do not know how to distinguish the taste qualities of the fruit, its resistance in transport, and the fertility of the trees. There would be a great advantage in bringing together all the forms under the same name, until better informed, so as not to complicate a nomenclature already fairly confused.

The North African Commission on Standardization has chosen the name Portuguese which is the one most used by producers and by the world of commerce. The market price lists of Paris mention only this name.

The Portuguese is the variety which is most widespread in Algeria. It gets its popularity from its incomparable taste. It is a beautiful orange of average size, creamy pulp, deliciously perfumed. Unfortunately it has only an average resistance in traveling, and a lower productivity than the Washington Navel.

The thickness of its skin varies greatly according to the land and the fertilizer. Variations occur in the bud, but less frequently than in the navel orange.

Double-fine.[4] - Synonyms: Entrefine, blood oval, double fine. (a) Form: Generally oblong; average weight 100 to 150 grams. (b) Skin: Adherent, thin, tough, fine grain, glossy and smooth; color, orange at first, blood red at maturity. (c) Seeds: Generally seedless, sometimes 1 or 2 small seeds. (d) Pulp: Very firm, juicy, becoming very red at the time of maturity. (e) Ripens: First of February to the end of March. (f) Observations: Lacks adherence to the tree, holds up well in transport.

The Double-fine is of Spanish origin, and is especially propagated in Oran.

Its principal quality lies in a great faculty for preservation. Some fruits which were packed in boxes in January 1942, put under a shed, and forgotten were well preserved until April of the same year (Larsen). Fruit is often still intact after lying on the ground for several days. This is due to a skin which, although thin, protects the fruit perfectly, because it is very tough. The Double-fine travels well, even in bulk, on wagons or on the balancelles (small Mediterranean craft) which are found in Mediterranean ports.

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[4] Known as Entre fina in Spain.

Improved Double-fine.[5] - Synonyms: Washington blood, Pedro Veyrat, blood oval, late heavy blood. (a) Form: Oblong, sometimes round. Weight 120 to 225 grams. (b) Skin: Less adherent than Double-fine, smooth. Becomes blood red in color between the end of December and the end of January, depending on the soil. (c) Seeds: Generally seedless. (d) Pulp: Medium-juicy, relatively consistent, colored in a less pronounced manner than the Double-fine. (e) Ripens: End of January, February. (f) Observations: Very adherent on the tree, holds up well in transport. A variety to be observed and studied.

This is a relatively new variety which originated at the experimental station of Burjasot (Spain). It is widespread in Oran, where it is liked for its early fruit. In nurseries, grafts of 2 years are found covered with oranges.

It is bigger than the Double-fine: 120 to 225 grams compared with 100 to 150 grams. It does not keep as well, but holds much better on the tree. This variety has to be observed before being definitely judged, and it would be unwise to plant it in great quantity for the moment in spite of its qualities. It matures, like the Double-fine, in February-March, sometimes a little sooner.

IV. Late Oranges (Ripening from March to June)

Valencia Late. - Synonyms: Brazilian (Pera), Hart's Late. (a) Form: Round, sometimes slightly oval (elongation of the skin near the stem). Weight 140 to 180 grams. (b) Skin: Medium-fine, firm, resistant, slightly grainy, slightly colored. Circular depression of 1 centimeter radius at the opposite pole from the stem. Tendency to turn green again in the summer. (c) Seeds: Often seedless, sometimes up to 6 seeds. (d) Pulp: Extremely juicy, tart, pleasing flavor, tough sections, well-colored at maturity. (e) Ripens: March-April, but keeps until June.

The feature of this variety is its tenure on the tree. The stem is attached so solidly that when you pull very hard on the fruit the skin comes off. This variety is extremely juicy and is better suited for the making of juice than it is for eating. Even though it arrives at a time when the fruit fly causes important damage, the Valencia does not seem to suffer much damage from this parasite.

The Valencia and the Washington Navel are the two main varieties found in California plantings of oranges. The Valencia is very vigorous and productive. This variety unfortunately has not been widely planted in North Africa, because of the increased cost of caretaking. Furthermore, one finds under this name forms which are far from having the qualities of the type. It seems that the well-known history of the Washington Navel has been repeated for the Valencia Late, and the first introduction was not successful. As a result, Algerian markets are completely deprived of oranges after the end of April. The metropolitan centers of consumption are in the same situation. A great gap is still to be filled in the summer oranges, and the Valencia Late is indicated for this purpose.

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[5] Known as Doble fina in Spain. It is the most important Spanish blood orange.

Vernia. - Synonyms: Bernia (Verna or Berna).6/ (a) Form: Regularly oval, turns up toward the neck, larger toward the pole farther from the stem, which is partially surrounded by a slight depression. Weight 100 to 150 grams. (b) Skin: Firm, grain rather fine, colored orange in January, becomes darker at maturity. (c) Seeds: From none to six, small and round. (d) Pulp: Medium-juicy, slightly tart, flavorless, well colored at maturity. (e) Ripens: March-April depending on the situation.

The Vernia is a late orange, like the Valencia Late, but it is far from possessing the qualities of the latter. Its conservation on the tree, in particular, is not as good.7/

V. Common Oranges

The common oranges constitute the mass of very old plantings. The fruits have many seeds. Many originated from seedlings so their qualities vary from tree to tree. Some interesting types may exist, but it is unlikely that any can surpass the selected varieties; it is unusual when a tree of merit is ignored for a long time and not propagated.

The common oranges are often fertile and well-adapted to local conditions.

The Blida, which is full of seeds, is of no more than historical interest. Some varieties, like the bloods of Biskra, have acquired a reputation which does not go beyond the local borders.

VI. Sweet Oranges

The sweet orange (lime-orange, Meski, Doucera, Imperial) is well-known, but is not planted to any great extent except in the native cultures of Tunisia.

It is so like the preceding oranges in appearance that the buyer is often deceived.

By reason of lack of acidity it is tolerated by sensitive stomachs.

The fertility and vigor of this variety is very great.

Its planting is not recommended because the very special taste of this orange is rarely pleasing to adult Europeans.

6/ Verna is the major type of late orange raised in Spain.

7/ In Spain the Verna is thought to be superior to the Valencia.

Clementine [8]

The clementine, a seedless early fruit, probably a cross between the tangerine and the orange, is a favorite in pre-Christmas European markets. This variety originated near Oran and has been widely planted in North Africa. Unfortunately, this tree does not produce regular crops, and experimental investigation has indicated extreme differences in production between trees in the same orchard and from one year to the next. Girdling has been tried in order to overcome this difficulty, but without general success.

The irregularity of production is most noticeable in young plantings. A few rare orchards contain clementines 30 to 40 years of age, and these old trees produce regularly each year. A few trees in most orchards produce well each year, and it is believed by experimenters that more experience with the variety may lead to the selection of scion stock with satisfactory production records.

It is also interesting to note that clementines planted in old orchards, where other varieties of orange are mixed-planted, have been observed to produce more regularly. Experimenters indicate that interpollination may be the reason for the better production records.

Lemons

Below are listed some of the varieties of lemons planted in Algeria with comments regarding these varieties in other North African citrus areas. For the study of varieties, Algeria is probably the best location. Tunisia is a very special case as it has a different climate from that common to most North African citrus areas, and the groves in Morocco are so young that the facts regarding each variety are not yet well known.

Eureka Lemon. This is the most important variety of lemon in Algeria. It fruits rapidly and produces an average size lemon which is very acid and juicy. In Algeria it produces primarily a winter lemon.

Lisbon Lemon. This variety is little planted in Algeria.

Lunari Lemon or Lemon of Palermo. This variety was brought to North Africa from Sicily. It is a very acid fruit and is excellent for the manufacture of citric acid. It gives good results in Tunisia and comprises most of the plantings in that section of North Africa. The winter fruits produced are very large, which is highly satisfactory to the domestic market in Tunisia and in other sections of North Africa, where a higher price is paid for a very large lemon.

Meyer Lemon. This variety is new to North Africa. It produces an excellent fruit, but the small size of the tree makes it primarily an ornamental.

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[8] Comptes Rendus de l'Experimentation fruitiere en Algerie, 1942, page 17.

Vernia or Bernia (Verna or Berna) Lemon. This variety originated in Spain and is planted for the production of summer fruit. The fruit of this variety is harvested in the spring. The fruits remain on the tree well, and harvesting can be delayed until late June. The tree has a very vigorous foliage growth which necessitates heavy pruning each year, and this disadvantage limits interest in the variety.

Grapefruit

Marsh Seedless. This American variety is generally grown in North Africa. It is the predominant commercial fruit for the very small European market. Plantings of this variety are not being extended because of the limited European market. An interest in this variety is found in the southernmost region of Morocco near Agadir where the very hot summer climate produces an excellent quality fruit.

Duncan. The seeded Duncan grapefruit is also planted to a very minor extent in North Africa.

Other Citrus

Citrons. This variety is planted to a very small extent and the fruit is exported primarily to Israel. The only commercial plantings of this variety occur in Tunisia. There are many varieties within this general classification. Some of the fruits produced in North Africa weigh as much as 8 pounds each.

Lime. The lime plantings in North Africa are distinctly limited. The only orchards in commercial production are in the vicinity of Tunis. The production is consumed locally. Both the lime and the citron are difficult to bud on the sour orange stock which is common to North Africa. In North Africa a lime produces a winter fruit.

Shaddock. The shaddock is cultivated primarily in the botanical gardens as a curiosity. The peel may be used in confections.

Tangelo. This variety is not known in the European fresh fruit market; however, as a juice fruit it has certain possibilities. The Fandson variety of tangelo is the one which is most planted. Most of the existing plantings were made at least 10 years ago, and it would be unusual to see any new plantings of this minor variety.

Excellent results have been obtained from the Wekuwa variety, which has large fruit with a dark orange peel and rose-colored flesh. It matures in early December, and in Algeria it is possible to hold the fruit on the tree until April. The fruit of the Samson is large and juicy.

Kumquat. The kumquat was planted to some extent before World War II, but plantings have not been extended since then. It is a curiosity and a garden ornamental, primarily.

Bitter Orange. The bitter orange is not of general importance in North Africa, and the only region of any commercial production is in Tunisia, where it is grown primarily for the leaves and blossoms which are used in perfumery.

Bergamot. The bergamot is very rare in North Africa. Only a few isolated trees are reported, and these are in Tunisia. This is an importation from the orchards in southern Italy where this tree is grown commercially primarily for the essential oil of the peel or citric acid.

Some Economic Factors

Taxation

The system of taxation in Algeria, as in France, is based partially upon income, the rate of tax varying with the amount of the net income as in the United States. Owing to the devaluation of the franc, the money income of individuals has increased, thus placing them in higher income brackets without any increase in real income.

Taxes on agricultural industries are collected first on a property valuation after the property has been placed in one of five classes, depending on improvements. Another tax is levied on the agricultural enterprise, in accordance with the net income. The individual owner of the property pays a further income tax upon his net income. All of the above factors are important in considering taxes as a portion of the cost of production in Algerian agriculture. Owing to the devaluation of the franc, a strict application of the income tax laws raises taxes to impossible limits, so agriculturalists say. Since a portion of the taxes is based upon the valuation, it is to the advantage of the operator of the agricultural property to obtain as low a classification as possible. For the computation of the income tax applying to the farm operation, it is desirable to show an accounting cost as high as possible.

Taxation is a very great problem to the North African citrus producer since the tax laws are based upon conditions existing before the devaluation of the franc which has taken place during the past 5 years. Since the devaluation of the franc, with its greater income in francs, what used to be normal incomes subject to normal tax have become incomes in high brackets and subject to a higher tax rate.

Price of Land

In 1949, industry representatives stated that a good orange grove, 15 to 20 years old, might sell for approximately 1 million francs per hectare ($1,264.67 per acre), and that irrigated land suitable for the planting of citrus would probably cost approximately 300,000 francs per hectare ($379.40 per acre). These prices are only estimates, since there is little sale of land.

The current high price of citrus land in Algeria reflects the profitableness of the industry. This has not always been true; in 1925, growers were removing citrus trees to plant vineyards.

Labor

Despite the large native population and the great numbers of people who seem to have ample leisure time, Algeria is faced with a great shortage of labor, as it is difficult to obtain employees who are capable of doing skilled or even semi-skilled work. The wage paid to labor is low. Orange pickers receive 250 francs ($0.78) a day. Men and women working at packing houses are paid approximately 45 francs ($0.14) per hour, about 135 francs ($0.41) per day. The output per worker is generally quite low, and even simple agricultural tasks require large numbers of workers.

The diet of the native is said to be quite smiple. In the desert areas, it consists primarily of dates; and in the coastal areas the fava bean is produced and consumed in considerable quantity. It is said that when rationing was in existence in Algeria many of the natives derived their primary source of income from the sale of rationed goods. The diet of the natives has been changed by wartime conditions. Since the armies introduced them to wheat flour, they have become accustomed to this new food, and this has reduced the export supplies of bread grains.

Land Tenure

Algerian citrus properties are owned by both Europeans and Moslems. The percentage now held by Moslems is small, and the fruit from these groves is primarily sold in the domestic market. It is the production from the European-operated groves which is important in international trade. Most of the citrus groves are very large (see table 10).

Table 10. - Algeria: Citrus groves
by number and size, 1944

Estimated number of groves	Size of grove	
	Hectares	Acres
900	0- 1	0- 2
3,200	1- 5	2- 12
2,500	5- 10	12- 25
2,100	10- 15	25- 37
1,100	15- 20	37- 49
2,500	20- 30	49- 74
1,400	30- 40	74- 99
1,300	40- 50	99-124
1,600	50- 70	124-173
1,300	70-100	173-247
900	100-150	247-371
500	150 and over	371 and over

Source: H. Rebour, Les Agrumes en Afrique du Nord, Algiers, 1945, p. 29.

Algeria operates under two systems of law - the French law and the traditional law of the native population. This dual legal system applies to land tenure. The French titles to land follwo Western customs, and once a title comes under the French jurisdiction, and is registered, it remains in this classification. Under Arab law, each child inherits from the father equally. Therefore, in only a few generations the title to land becomes a confusing interlacing of many equities. For example, 50 or more Arabs may have varying titles to the crop from a small piece of land with one olive tree. The practical net result is that much of the land held under Arab law, which still comprises a very large part of Algeria, is in a status of communal property. Under these conditions it is easy to understand the obstacles in the way of the development of intensive agriculture on Arab holdings. The purchase of Arab land by Europeans also presents difficulty owing to the problem of obtaining a clear title.

Practically all the large commercial plantings of citrus are held by Europeans who acquired them from Arabs many years ago after the French conquest of Algeria.

Cost of Production

Algeria is the oldest commercial citrus area in North Africa, having had exportable citrus crops since 1900. The factors of orchard yields and the costs of grove operation are better documented than in either of the other two French North African areas. The rapid expansion of citrus plantings is ample indication that in recent years citrus growing has been a profitable enterprise. Growers estimated that orange orchards with reasonably good production in 1948 received a net profit of approximately 200,000 francs per hectare ($252.93 per acre) after all operational costs were paid.

The four important production costs are: fertilizers; pumping irrigation water; pest control; shipping containers. The high cost of electric power makes pumping irrigation water expensive, and the other three items are costly because they involve materials which have to be imported.

Yield of Algerian Citrus Groves

The actual records of the yield of 45 representative Algerian citrus groves are given in table 11 for the period from 1944 to 1948. These records illustrate the character of the Algerian citrus industry, and it will be noted that some of the tangerine groves were planted as early as 1885. The effect of the war on yields is clearly seen in the records for 1945 and 1946.

Table 11. - Algeria: Yield of 45 citrus groves, 1944-48

Variety and date of planting	Yield per acre				
	1944	1945	1946	1947	1948
	Boxes	Boxes	Boxes	Boxes	Boxes
Clementine:					
Planted 1936............	56	41	34	31	73
Planted 1928-36..........	14	16	21	13	55
Planted 1931-35..........	23	20	18	29	76
Planted 1931............	34	56	25	125	191
Planted 1932............	191	145	242	265	407
Planted 1913............	71	190	166	194	484
Satsumas:					
Planted 1938............	6	1	8	18	78
Planted 1931............	57	119	384	80	459
Planted 1933............	67	26	176	210	395
Planted 1927............	148	310	223	496	539
Tangerines:					
Planted 1919-29..........	66	87	91	76	196
Planted 1912-22..........	93	55	110	75	191
Planted 1918-30..........	95	50	135	119	264
Planted 1898-1921.......	90	175	115	125	255
Planted 1870-1925.......	228	152	198	153	171
Planted 1870-1900.......	210	191	303	235	382
Thomson Navel:					
Planted 1939............	0	0	0	0	15
Planted 1928-34..........	82	75	82	98	144
Planted 1933............	66	47	45	61	286
Planted 1930............	117	36	56	173	237
Planted 1932............	233	170	303	368	535
Planted 1920............	335	193	161	330	375
Blond (White-nonblood):					
Planted 1910............	115	213	80	189	298
Planted 1920............	145	154	82	144	354
Planted 1925............	156	168	84	186	337
Planted 1920............	175	154	148	247	335
Planted 1912............	200	136	217	268	325
Planted 1899............	338	268	171	365	438
Portuguese (Semi-blood):					
Planted 1935............	27	10	26	63	130
Planted 1936............	26	83	45	115	291
Planted 1938-39..........	28	31	51	78	190
Planted.1925............	38	365	79	191	315
Planted 1920............	124	162	25	305	331
Planted 1920............	99	229	108	326	349

Continued--

Table 11. - Algeria: Yield of 45 citrus groves, 1944-48, continued

Variety and date of planting	Yield per acre				
	1944	1945	1946	1947	1948
	Boxes	Boxes	Boxes	Boxes	Boxes
Jaffa (Shamouti):					
Planted 1920	13	128	32	210	166
Planted 1912	56	140	223	366	427
Planted 1920	103	222	179	306	300
Planted 1899	77	149	112	357	312
Valencia:					
Planted 1939	8	1	17	8	42
Planted 1936	31	15	43	38	167
Planted 1941	15	40	64	141	163
Planted 1921	270	241	203	553	343
Vernia (Bernia) (Verna):					
Planted 1941	14	6	3	33	90
Grapefruit:					
Planted 1936	161	104	172	138	446
Planted 1933	161	207	191	267	325

Source: Algeria packing house records.

A number of groves, primarily orange plantings, were planted after 1935 and are therefore not in full bearing. The age of these young groves must be taken into consideration when making comparisons of yields. In order to eliminate this factor of bearing age, records of groves planted before 1935 have been used in determining a central tendency of the yield of these citrus groves. An inspection of the data indicates that there is a considerable range in the yield of most of the groves. However, in normal years the majority of the groves have a yield which falls between 12,500 and 25,000 kilograms per hectare (159 and 319 boxes per acre). Spot estimates of the crops on the trees in 1949 confirmed these figures as a reasonable range of yield for Algerian commercial citrus groves.

Cost of Operating Algerian Citrus Groves

The cost of operating an Algerian citrus grove will depend upon its location. A grove which is able to obtain gravity irrigation water will be cheaper to operate than one where pumping is necessary. The operational costs will also vary according to whether animals or a tractor are used. From observation it would seem that there are few European-owned citrus plantings in which cultivation is done with teams.

The calculations of the cost of operating Algerian citrus groves given in tables 12 and 13 were compiled by interested citrus organizations, and may be considered as quite representative of cost conditions. In 1946-47 the total cost of cultivating one hectare of oranges as itemized in table 12 was 79,000 francs per hectare ($99.91 per acre). Forty-six percent of the total was made up of cash cultural costs and the remainder consisted of general costs and amortization. The actual cash costs were therefore less than $50 per acre as of 1946-47. In the second operational cost calculation (table 13) the cost of operations ranged from 56,055 francs per hectare in 1945-46 to 92,929 francs per hectare for cultivation with a team in 1946-47. The difference in the dollar cost is due to the fluctuation of the franc since the exchange rate was about 119 francs to the dollar in 1945-46 and about 320 francs to the dollar in 1946-47.

These cost data are given in some detail and indicate the cultural operations performed in operating an Algerian citrus grove. Of particular interest are the wages paid to the native Algerians who are the primary source of labor in cultural operations. Included in the cost factors is a charge for guards for the grove. When fruit is ripe and ready for harvest, groves must be guarded 24 hours a day in order to prevent the pilferage of fruit. Amortizations represent a considerable percentage of the costs as calculated.

When Algerian citrus growers were asked about their operational costs, 100,000 francs per hectare per year was about the highest figure mentioned. Considering the cultural operations as observed, the statements of growers, and the cost data as compiled by Algerian citrus organizations, it seems likely that the average Algerian citrus grove was operating in 1949 at cash costs ranging from 60,000 francs per hectare to 100,000 francs per hectare.

Table 12. - Algeria: Cost of cultivating oranges, 1946-47 season

Item	Francs per hectare	Dollars 1/ per acre
Cultivation:		
Labor (7½ days)	1,156	
Tractor (1½ days at 1,560 francs per day)	2,340	
Total	3,496	4.42
Expenses of cultivation:		
Labor (9½ days)	974	
Apply 60 kilos of lime	175	
Total	1,149	1.45
Pruning: 2/		
Labor (8½ days)	955	
Labor, "piece work"	1,990	
Tractor (¼ day at 1,500 francs per day and ½ day at 740 francs per day)	745	
Horses (1 day at 230 francs per day)	230	
Total	3,920	4.96

Continued--

Table 12. - Algeria: Cost of cultivating oranges, 1946-47 season, continued

Item	Francs per hectare	Dollars 1/ per acre
Fertilization:		
Labor (2½ days)	268	
Tractor (¼ day at 1,500 francs per day)	375	
Horse (¼ day at 230 francs per day)	57	
Total	700	.89
Supplies:		
Sulfate of ammonia (4 kilos at 1,000 francs per kilo)	4,000	
Complete fertilizer (10 kilos at 696 francs per kilo)	6,960	
Total	10,960	13.85
Irrigation:		
Labor (8 days)	1,250	
Tractor (¼ day at 740 francs per day)	185	
Gas-oil (621 at 8.4)	520	
Electricity (380 kw. at 8)	3,040	
Total	4,995	6.32
Harvesting:		
Labor	1,345	
Labor, "piece work"	5,450	
Gardening for grove (10 days)	1,215	
Tractor (1¼ days at 740 francs per day and ¼ day at 1,560 francs per day)	1,315	
Total	9,325	11.79
Miscellaneous:		
Labor	1,118	
Labor, "piece work"	560	
Tractor (¼ day at 1,560 francs per day)	390	
Horses (¼ day at 230 francs per day)	57	
Total	2,125	2.69
Total cultural costs	36,670	46.37

Continued--

Table 12. - Algeria: Cost of cultivating oranges, 1946-47 season, continued

Item	Francs per hectare	Dollars 1/ per acre
General Expenses (80 percent of cultural costs):		
General service	9,400	
Management	8,200	
Administration (including office in Algiers)	2,200	
Taxes and duties	1,800	
Upkeep and repair	7,600	
Total	29,200	36.93
Total cost of cultivation	65,870	83.30
Amortization:		
Buildings (30,000 per ha. at 6 percent)	1,890	
Improvements (27,000 per ha. at 6 percent)	1,900	
Trees (80,000 per ha. at 3 percent)	2,400	
Equipment (34,500 per ha. at 20 percent)	6,940	
Total	13,130	16.61
GRAND TOTAL	79,000	99.91
Recapitulation of costs:		
Cultural costs	36,670	(46 percent)
General costs	29,200	(37 percent)
Amortization costs	13,130	(17 percent)

1/ Francs converted at 320 francs to the dollar.
2/ Grove was pruned lightly.

Source: As computed by an Algerian growers organization.

Table 13. - Algeria: Cost of operating a hectare of citrus, 1945-46 and 1946-47

Item	1945-46		Cultivation with tractor: 1946-47		Cultivation with horses 1946-47	
	Francs per hectare	Dollars per acre 1/	Francs per hectare	Dollars per acre 2/	Francs per hectare	Dollars per acre 2/
Cost of cultivation:						
Irrigation	---	---	12,205	15.43	12,205	15.43
Discing	16,550	56.14	10,547	13.34	12,960	16.39
Pruning	---	---	3,552	4.49	3,552	4.49
Fertilizer:						
Manure	4,000	13.57	7,450	9.42	8,400	10.62
General fertilizer	9,380	31.82	7,840	9.91	7,840	9.91
Pest Control:						
Fumigation	1,375	4.66	3/ 2,815	3.56	3/ 2,815	3.56
White spray oils	3,750	12.72	5,125	6.48	5,125	6.48
Amortization:						
Implements	2,500	8.48	---	---	---	---
Tractors	500	1.70	2,950	3.73	4,200	5.31
Improvements	---	---	---	---	---	---
Trees	3,500	11.87	5,000	6.33	5,000	6.33
General costs	3,000	10.18	12,296	15.55	11,332	14.33
Duties and taxes	7,500	25.44	12,300	15.56	12,300	15.56
Interest on capital	4,000	13.57	4,000	5.06	4,000	5.06
Rental of buildings	---	---	3,200	4.05	3,200	4.05
Total	56,055	190.15	89,280	112.91	92,929	117.52

1/ Converted from francs at 119.30 francs per dollar.

2/ Converted from francs at 320 francs per dollar.

3/ One-fourth of the trees each year, 45 francs per tree, 250 trees per hectare = $\frac{250}{4}$ X 45 = 2,815 francs per hectare.

Source: As computed by an Algerian growers organization.

Summary of Production Costs

Utilizing the yield and operational cost factors mentioned above, the range of the cost of production for Algerian groves in 1949 is as follows:

	High 1/	Low
Cash costs estimated in 1949:		
Francs per hectare	100,000	60,000
Dollars per acre 2/	126.47	75.88
Average range of yield: 1/		
Kilos per hectare	25,000	12,500
Boxes per acre	319	159
Cost of Production:		
Francs per kilo	4.8	4.0
Dollars per pound 2/	0.007	0.0057
Francs per 30-kilo (66-pound) box	144.0	120.0
Dollars per 66-pound box 2/	0.45	0.38

1/ High yield is compared with high operation costs, for one is usually a function of the other.

2/ Converted from francs at 320 francs to the dollar.

All of the above statements apply to European-operated commercial groves. The cost of production on small native-operated establishments would be very difficult to estimate; since no commercial fertilizers are applied and little pest control is practiced, cost, as we know it, would be practically nonexistent. The native plantings are not important from an export standpoint.

Break-even Costs for Algerian Citrus f.o.b., Algerian Ports

The above cost-of-production data and the costs of picking, packing, and transport which are given in the Marketing section permit the calculation of the break-even costs for the production of Algerian citrus. The break-even costs include the cash costs of producing the fruit, the cash costs of picking, packing, and transporting it to port without profit to the grower, packer, or shipper; they do not include charges for amortization.

These break-even costs have been computed as a range since this is the most representative presentation. The break-even cost factors are significant because they are the costs which it is estimated would have to be met in order to keep the Algerian citrus grower in business.

It is interesting to note that the cost of picking and packing is nearly three times the cost of the production of the fruit itself.

	High	Low
Cost of production:		
Francs per kilo..................	4.80	4.00
Dollars per pound................	0.007	0.0057
Cost of picking and packing:		
Francs per kilo	12.60	9.10
Dollars per pound,...............	0.018	0.013
Transport to port:		
Francs per kilo..................	0.50	0.50
Dollars per pound................	0.0007	0.0007
Total;		
Francs per kilo..................	17.90	13.60
Dollars per pound................	0.025	0.019
Francs per 30-kilo (66-pound) box.	537.00	408.00
Dollars per 66-pound box..........	1.68	1.28

Marketing

Algeria is a far older commercial citrus district than either Morocco or Tunisia, and one cooperative organization in Algeria has been in operation for the last 25 years. The marketing of citrus fruits in Algeria is somewhat different from that in Morocco where at present large quantities of fruit are sold to fruit buyers. In Algeria, cooperatives have long been in operation and, while there are some fruit buyers, they have not been as important as in Morocco. An important new development in marketing is the purchase of on-the-farm packing plants by large citrus growers. At least 25 of these new packing plants have been installed within the last year. They are all of American manufacture.

Many of the Algerian citrus groves are large operations containing as many as 500 acres in one planting. It is quite customary to raise other crops such as wine grapes. Many of the largest operators have wineries on their property. The central buildings of these farms are excellent stone structures containing machine shops, stables, garages, and dwellings. It is usually possible to find a building suitable for the packing house without additional construction. These new packing houses will make a change in the marketing situation in Algeria as the growers pack and sell their own fruit under their own brand names.

Harvesting and Packing

Harvesting is done by native labor. Since the trees are small, no ladders are used in picking, and any fruit which is out of reach is obtained by climbing the tree. Much of the picking is done by hand as clippers are no longer obtained from Germany and attempts to interest French manufacturers in the production of clippers have so far been unsuccessful. Pickers, without clippers or picking bags, were seen taking two or three oranges at a time by hand and placing them in a wicker hamper. These wicker hampers, which hold about 35 pounds, are carried into the orchard by hand. In wet weather, the filler hampers are carried to the roadside, where they are loaded in trucks for transport to the packing house. Pickers receive 250 francs ($0.78) per day, and 40 men pick approximately 10 metric tons (11 short tons) per day, each man picking about 250 kilos (551 pounds).

The hampers are carried by hand from the truck to either the processing or packing house. At times, fruit is hand-sorted after being unloaded from the truck, and the fruit is separated into two qualities, one for processing and one for fresh fruit shipment. No mechanical grading tables are used for this operation. The wicker hampers are merely placed on the ground and all work is performed by hand. At the packing house the fruit is dumped into a washer, and the washing and drying of the fruit usually comprise the entire preparation for market. In some of the newer packing houses a simple waxing machine is also used. After washing and drying, the fruit is transported by conveyor to be sized and dropped into the packing bins. Any fruit that is unfit for export shipment is placed in a basket which stands under the box being packed. The fruit is bare-packed, but it is placed in a pattern arrangement similar to United States packing. Native women do the grading and packing, and are paid approximately 45 francs ($0.14) per hour for skilled tasks.

Fruit for European export is packed in the 30-kilo (66-pound), two-compartment box and the traditional billot.[9] In one packing house visited, advertising material was being inserted in each box of fruit.

The shook for the 30-kilo boxes is imported from France. The boxes cost approximately 175 francs ($0.55) at the packing house. The billot costs approximately 80 francs ($0.25) at the packing house. The billot is received prefabricated, since its shape permits it to be nested. The cost of manufacturing the 30-kilo box at the packing house was estimated at approximately 4 francs ($0.012) a box, 50 centimes of which is for nails and 3.50 francs ($0.01) for labor.

After the fruit is packed, it is shipped by rail to the docks for transport to Europe. One shipper estimated that the cost of bringing the fruit from the tree to the shipping car packed in a 30-kilo, two-compartment box was approximately 12.60 francs per kilo ($0.018 per pound). This cost, which is higher than other estimates obtained, includes all labor, picking, hauling, and materials. The transport cost from the packing house to the dock is approximately 1 franc per kilo ($0.001 per pound). The tree-to-shipping-car cost is lower when the billot is used--only 9.35 francs per kilo ($0.013 per pound). The cost of fruit packed in billots, f.a.s., Algeria, is approximately 17.85 francs per kilo ($0.025 per pound).

9/ The billot is an oval basket container like an oval bushel basket. It is used for tangerines and sometimes oranges.

Fruit is transported by hand at the packing house. It receives very rough handling, and much fruit is lost as a result. In computing the true cost of the fruit shipped, shippers state that a loss of 30 to 50 percent in grading and handling must be taken into consideration.

The packing houses issue a bread ration to their employees, as is required by law for all agricultural workers. The employees line up and receive their bread as they are checked off the list.

The package of fruit for export is of good appearance, and of quite good grade. The French box shook is heavy by United States standards; the top pieces are too heavy to make a satisfactory bulge pack, and the fruit is crushed when this type of pack is attempted. The shook is also somewhat brittle and may split at the end when it is nailed on.

Packing Cost

The most important packing cost in Algeria is the cost of the shipping containers which may be half the value of the fruit itself. The wage rates make the cost of labor seem reasonable; however, it is not as reasonable as it might appear since labor is inefficient. The daily output per worker is usually quite low, and a great deal of fruit is damaged in handling.

From the data obtained it may be estimated that the cost of picking and packing in 1949 ranged from 12.60 francs per kilo to 9.10 francs per kilo including all labor and material costs from the grove to point of shipment from the packing house. A breakdown of the low figure of 9.10 francs per kilo is given in table 14.

Table 14. - Algeria: Cost of packing oranges, 1948-49, as estimated by a citrus packer

Picking and packing	Francs per kilo	Dollars per pound
Box (30-kilo)................	6.000	0.00851
Picking.....................	0.850	0.00120
Strapping...................	0.309	0.00044
Staples.....................	0.030	0.00004
Box labels..................	0.064	0.00009
Waxing......................	0.250	0.00035
Handling and amortization....	0.720	0.00102
Affixing label...............	0.012	0.00002
Advertising (put in box).....	0.008	0.00001
Paper lining.................	0.357	0.00051
Subtotal....................	8.600	0.01219
Manpower (labor), packing....	0.500	0.00071
Total......................	9.100	0.01290
Total per 30-kilo (66-lb.) box	Francs per box 273.00	Dollars per box 0.85

Note: A 30-kilo "Florida" nail box cost 125 francs ($0.39) in Algeria in 1949. The average daily wage of an unskilled citrus fruit packer in 1949 was 135 francs ($0.42) per day.

Transportation

In Algeria the transportation facilities for citrus fruits from the groves to the shipping pier are excellent. Transportation from the grove to the packing house is almost always by truck; transportation from the packing house to shipping pier may be either by truck or by railroad.

The most common port of shipment is Algiers, which serves as an outlet for the largest portion of the citrus industry. Other ports are Oran, Bone, and Philippeville. The fruit is carried across the Mediterranean by boats to Marseilles or Port Vendres, where it is unloaded and placed in rail cars for shipment to French markets. Trucks are also used for relatively short hauls.

The combined sea and rail rates from Algiers to Paris range from $0.90 to $1.22 per box, depending upon the port at which the fruit is landed and the capacity of the rail car (see table 16).

Transportation costs have been a big influence on the ability of Algieria to compete with Spain in French markets. As long ago as 1925 Algerian citrus growers were complaining that Spain could place fruit on French markets at a much lower cost than the Algerian fruit, primarily because of freight rates.

Table 15. - Algeria: Sea freight rates for citrus fruits, March 1950

Port of origin and destination	Rate per metric ton	Rate per box
	Francs 1/	U.S. dollars
Algiers to:		
Marseille	4,180	0.41
Port Vendres	4,180	0.41
Le Havre	4,660	0.46
Rouen and Channel and northern ports	4,600	0.46
Liverpool	4,500	0.45
Algiers to:	Shillings 2/	
Liverpool	80	.36

1/ French francs converted at 320 francs to the dollar.
2/ English shilling converted at 14 cents per shilling.

Source: Rates obtained from official sources by the American Consulate General at Algiers and the Office of the Agricultural Attache, American Embassy, Paris.

Table 16. - Algeria: Combined sea and rail rates, Algiers to Paris

Rate	Via Marseille		Via Port Vendres	
	Francs per metric ton	Dollars per box	Francs per metric ton	Dollars per box
Sea	4,180	0.41	4,180	0.41
Rail, 3-ton car	7,493	0.74	8,119	0.81
Total	11,673	1.15	12,299	1.22
Sea	4,180	0.41	4,180	0.41
Rail, 5-ton car	5,414	0.54	5,867	0.58
Total	9,594	0.95	10,047	0.99
Sea	4,180	0.41	4,180	0.41
Rail, 8-ton car	4,898	0.49	5,308	0.53
Total	9,078	0.90	9,488	0.94

Note: Loading charge at Algiers per metric ton 363 francs ($0.04) per box. Unloading charge at Marseilles 1,326 francs per metric ton ($0.13 per box). Loading and unloading charges are variable and are unknown at other points.

Domestic Marketing

In 1948, according to production estimates and indicated exports, the domestic consumption in Algeria was approximately 1,157,553 boxes of oranges, 624,793 boxes of tangerines and clementines, and approximately 35,439 boxes of lemons. These consumption figures include the fruit used in processing as well as that sold in the fresh fruit market.

The domestic market for citrus fruit in Algeria would be excellent all year round if summer supplies were available. Some growers are installing refrigerated storage facilities on the farm as a part of their packing operations. Valencia (or Verna) oranges are picked in June and kept under cool storage until August, when they are sold to the local market in Algiers for as much as 100 to 150 francs per kilo retail ($o.14 to $o.21 per pound). The refrigeration equipment observed was all of American manufacture. The fruit observed seemed to be in good condition, and some growers plan to treat fruit with borax and wax prior to storage.

In August, fruit is removed from cold storage and is graded and packed in billots. This is a small-scale, hand operation performed by women and children who may receive 200 francs ($0.63) for an 8-hour day. This would seem to be an excellent way of prolonging the marketing of fruit since North Africans are used to citrus, and supplies are very low in July, August, and September.

In August 1949, a small quantity of oranges which had been held in cold storage were observed selling retail at 100 francs per kilo ($0.14 per pound) in Algeria, and lemons were retailing at an average of 70 francs per kilo ($0.10 per pound).

In the winter citrus season, the average price for oranges was 30 francs per kilo ($0.04 per pound).

Export Marketing

The export of citrus fruit from Algeria is controlled by a Government sponsored organization, and regulations cover the grade of fruit to be shipped, its quality, and the type of containers which may be used. (Excerpts from export regulations are included in the appendix.) The enforcement of these control measures should ensure the quality of Algerian exports to European markets.

In 1940-41, exports of tangerines and clementines were larger than the exports of oranges, but oranges have been more important in the postwar years. Exports of all citrus have increased rapidly in the postwar period (see table 17). In the 10-year period since 1940-41, however, the greatest increase has taken place in orange exports. Over 3.3 million boxes of oranges were exported in the 1950-51 season to March. Exports of lemons have also been larger in the postwar period, but the 80,640 boxes exported in the 1950-51 season to March was only about 18,000 boxes larger than the exports in the 1940-41 season. In this 10-year period grapefruit exports have increase, but the 34,110 boxes exported in this season to March indicate the relative unimportance of this type.

Export seasons. The seasonal pattern of citrus exports from Algeria is illustrated in table 18. Clementines, the earliest citrus variety, have the shortest export season and are shipped in volume only in November, December, and January. Tangerines and satsumas are not exported in large quantities until December, and the major shipping season extends through March. Clementines reach their peak volume in December, and tangerines and satsumas are shipped in heaviest volume in January. The export of oranges begins in November but does not reach important volume until December, and February and March are the months in which peak shipments are made. Exports of oranges continue through June, and in 1950 they were higher in May than in November. Small quantities of oranges were exported in the summer of 1950, probably either cold-storage or "off bloom" fruit. Lemons were exported in every month of 1950; exports in July were more than double those of any other month in 1950, and exports in February, June, and October were also important. Grapefruit was exported from November through May in 1950, with the heaviest shipments taking place in November and December.

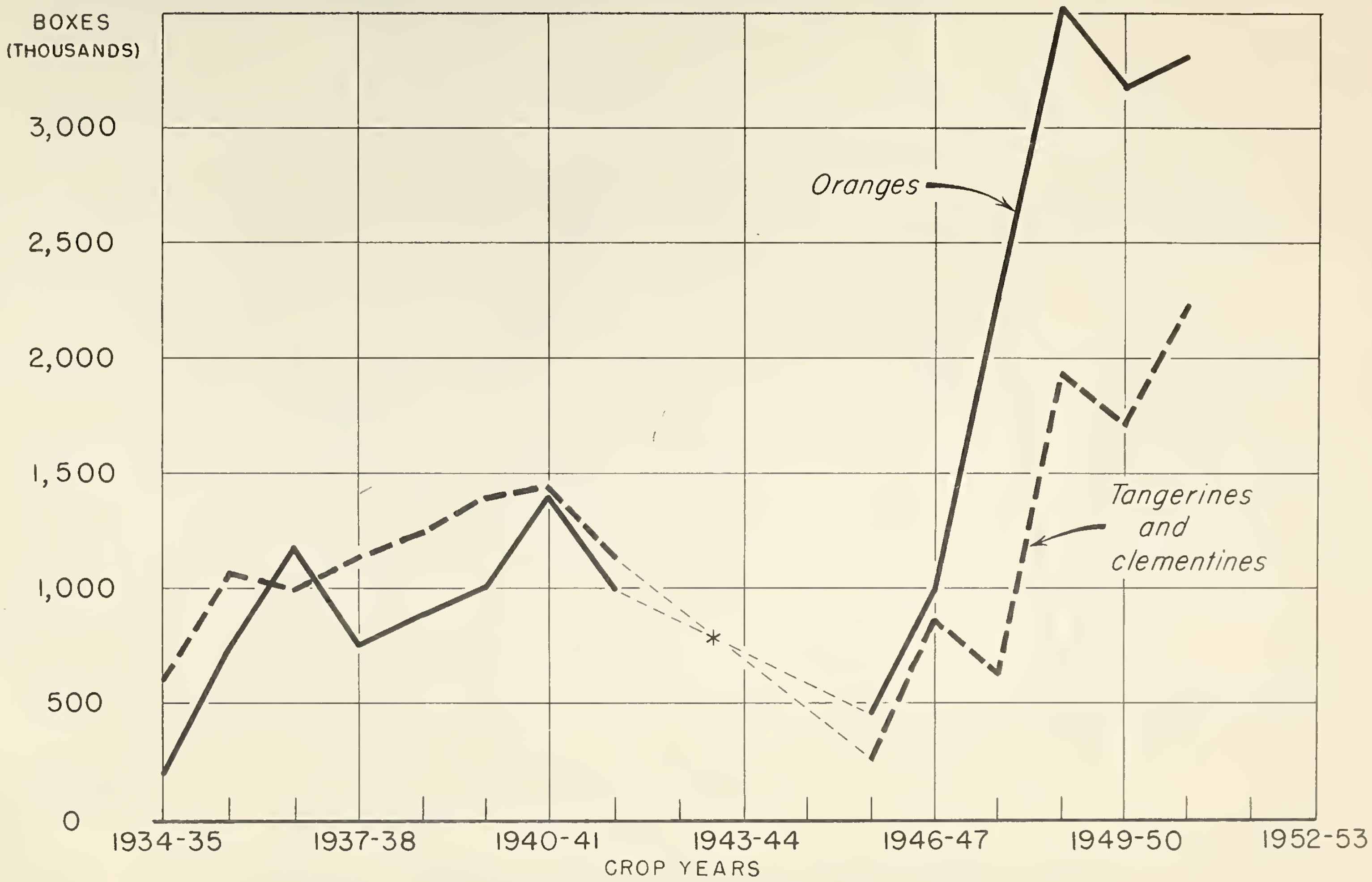
Table 17. - Algeria: Citrus exports, by types, 1934-35 to 1950-51

Crop year	Oranges	Tangerines	Clementines	Tangerines and Clementines	Lemons	Others
	Boxes	Boxes	Boxes	Boxes	Boxes	Boxes
1934-35	191,523			591,768		
1935-36	723,663			1,061,943		
1936-37	1,152,049			994,047		
1937-38	756,657	920,342	215,024	1,135,366	13,500	2,000
1938-39	888,964	1,129,426	110,872	1,240,298	6,904	4,649
1939-40	1,009,971	1,262,940	131,366	1,394,306	34,142	1,276
1940-41	1,398,778	1,017,650	418,238	1,435,888	62,280	4,330
1941-42	995,620	988,442	144,723	1,133,165	16,094	10,318
1942-43 1/						
1943-44 1/						
1944-45 1/						
1945-46	457,543	167,600	95,393	262,993	47,521	10,450
1946-47	981,324	695,699	162,205	857,904	65,865	33,141
1947-48	2,263,580	456,488	166,422	622,910	39,665	17,829
1948-49	3,522,403	1,470,087	453,354	1,923,441	124,017	39,714
1949-50	3,172,939	1,212,684	496,952	1,709,636	54,314	22,196
1950-51 2/	3,304,936	1,412,982	807,484	3/ 2,220,466	4/ 80,640	34,110

1/ Exports suspended due to war.
2/ Through March 1951.
3/ Probably includes some satsumas.
4/ Probably includes some citrons.

Source: Official sources.

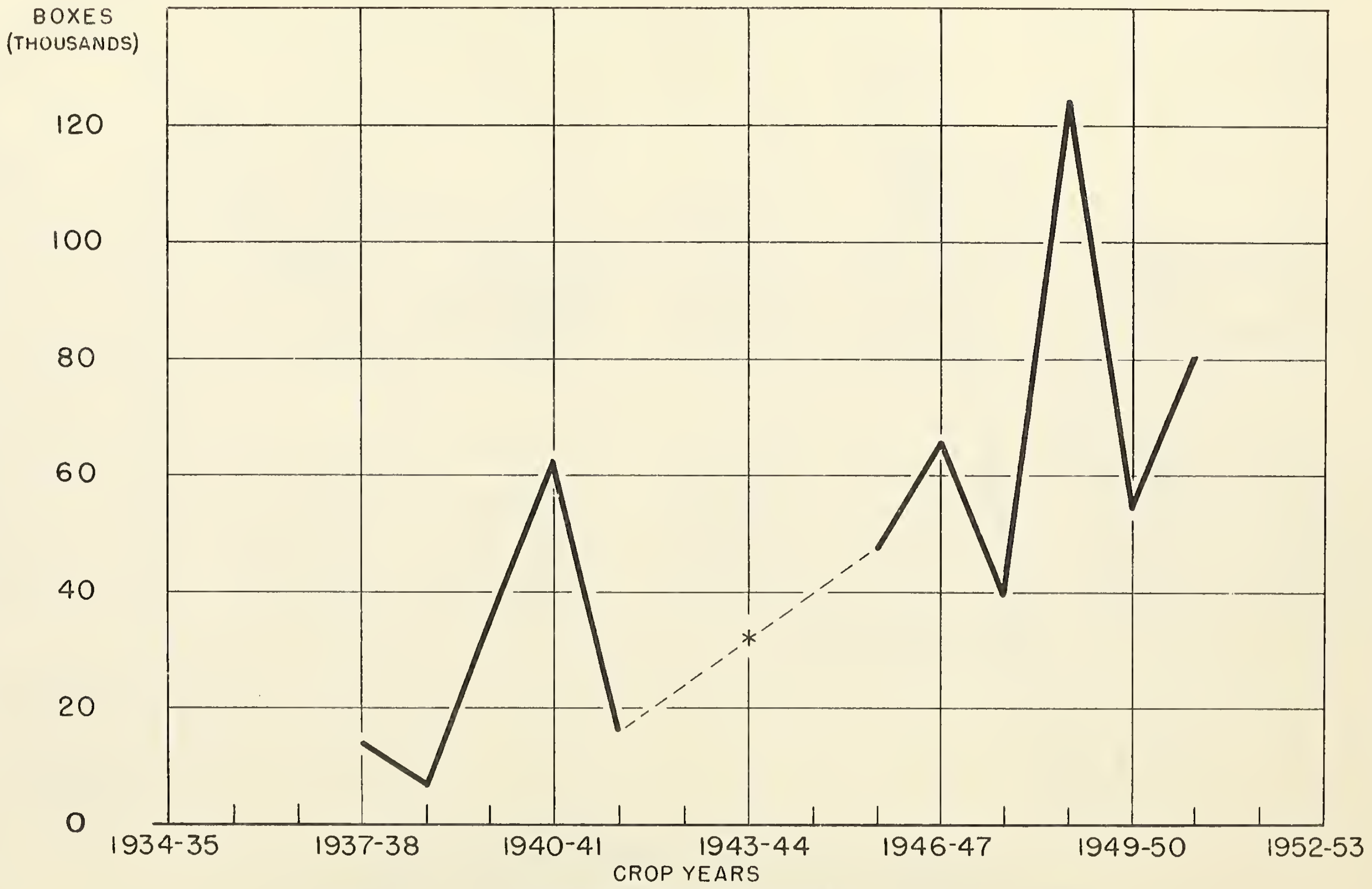
ALGERIA: EXPORTS OF ORANGES, TANGERINES AND CLEMENTINES, 1934-35-1950-51



*EXPORTS SUSPENDED DUE TO WAR

U S DEPARTMENT OF AGRICULTURE NEG. 1761 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

ALGERIA: EXPORTS OF LEMONS, 1937-38-1950-51



*EXPORTS SUSPENDED DUE TO WAR

U.S. DEPARTMENT OF AGRICULTURE NEG. 1760 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Table 18. - Algeria: Citrus exports by kind and month, 1950

Month	Oranges	Clementines	Tangerines and satsumas	Lemons	Grapefruit
	Boxes	Boxes	Boxes	Boxes	Boxes
January	328,766	54,164	558,948	3,118	2,265
February	946,444	2,324	336,283	5,047	4,985
March	782,287	135	137,161	3,722	4,462
April	395,471	230	4,368	2,619	1,177
May	150,102	-	3	4,815	1,761
June	52,331	-	50	8,508	36
July	1,124	-	-	20,712	-
August	246	-	-	3,075	-
September	513	-	-	4,720	-
October	721	1,061	72	8,186	201
November	138,751	199,129	10,352	920	10,943
December	488,725	541,718	165,036	1,836	5,302

Source: Algerian Customs, as reported by Richard C. Desmond, American Consul, Algiers.

Export customers. France has been the traditional customer for Algerian citrus, and a few tangerines and clementines have been shipped to the United Kingdom each year, but increasing production has made it necessary to develop new export markets. This new export situation is illustrated in table 19, which gives 1950 exports by kind of fruit and country of destination. In 1950 over 2.7 million boxes of oranges were exported to France and over ½ million boxes to Germany. Lemons, tangerines and grapefruit were also exported to France and Germany, and clementines were shipped to France and the United Kingdom. The new export outlet in Germany was welcome to Algerian exporters and probably prevented market gluts in France. As production increases, new markets will become more important. This will necessitate a change in packing procedure, as exports to countries other than France and Germany will probably have to be wrapped. When Algeria exports in volume to non-French markets the soundness of the new orange industry will be tested. Algeria has not yet proven that it can compete with other citrus-producing areas in non-French markets.

Table 19. - Algeria: Citrus exports by kind and country of destination, 1950

Destination	Oranges	Clementines	Tangerines and satsumas	Lemons	Grapefruit
	Boxes	Boxes	Boxes	Boxes	Boxes
France	2,713,643	797,754	1,210,533	63,400	30,195
French Union	951	60	-	122	-
Ships' Provisions	6,245	41	94	302	-
Germany	559,291	-	1,430	3,455	386
United Kingdom	4,604	501	-	-	-
Other	746	406	217	-	548

Source: Algerian Customs, as reported by Richard C. Desmond, American Consul, Algiers.

Export outlook. The greatest obstacle to Algerian exports is freight rates. It costs $0.41 per box to ship a box of oranges from Algiers to Marseille and $0.46 per box from Algiers to Channel ports. In 1950 it cost only $0.72 to ship a box of oranges from South Africa to Antwerp, Belgium. Another factor is that the citrus season in Algeria is almost the same as in Spain, and Algeria must, therefore, compete directly with Europe's largest orange supplier. Expanding production will undoubtedly result in increased exports in the future, but the success of Algerian exports does not seem to be so assured as that of Morocco where the citrus season is earlier than in Algeria or Spain.

On the basis of potential production, Algerian exports by 1960 are likely to reach 4 million boxes of oranges, 2.5 million boxes of tangerines and clementines, 125,000 boxes of lemons, and 40,000 boxes of grapefruit.

Processing

The citrus processing industry of Algeria has been developed during the last 10 years in an attempt to obtain a satisfactory market outlet for fruit which is unfit for export in fresh form. One plant, however, has been in operation for 25 years. The possibilities of expanding the processing industry in Algeria would seem to be limited by the variety of citrus fruits raised since the varieties available for processing are early oranges, and a large percentage of orange production is of the blood varieties which are of lesser value as a processing fruit. Tangerines and clementines are also types of fruit which do not readily lend themselves to mechanical processing. Algeria has some nonblood, late oranges, such as the Valencia Late, but these are in small supply, and their value as fresh fruit usually precludes their use as a processing fruit.

Location of Processing Plants

Processing plants are located in the most important orange-producing areas. One new installation is in the district of Oran at Orleansville, two plants are located near Algiers at Birkadem and Boufarik, and another large plant of American manufacture is to be installed near Algiers. There are also several small installations in the citrus districts and in Algiers, some of which do not process juice products but merely make jams, marmalades, and peel products for confection.

Characteristic Processing Plant Operation

The very short citrus season makes it impractical to devote a plant entirely to the production of citrus products. All the plants visited were multipurpose installations which usually process grape products as well as citrus. In the vicinity of Algiers many of the plants also process tomatoes and tomato juices in season. For this reason, much of the equipment is multipurpose, and the part which is specialized for citrus is dismantled at the end of the citrus season.

The management and major operating personnel are usually Europeans. The labor around the plant generally consists of native Algerians.

Processing Equipment

All of the processing plants visited had at least a part of their juicing capacity in the form of hand extractors. The juice extractors, pipes, and other equipment in all of the plants were of stainless steel, and the sanitation standards observed seemed quite satisfactory. In the processing plants visited the fruit was first washed mechanically, then carried by conveyors to a machine where it was sliced into halves, and then fed by conveyor belts into the hand juice extractors. As the spindles on the extractors were of only one size, the fruit was unsized before going to the extractors, small fruits were not juiced properly, and only a portion of the juice was extracted from the large fruits.

After the juice was extracted it usually wnet through a filtering process for the removal of seeds and larger pieces of pulp and then as deaerated, flash-pasteurized, and canned in tin containers.

The machinery used is a mixture of French and American manufacture. Most of the extractors seemed to be of French manufacture, and almost all of the automatic canning apparatus was of American manufacture.

Types of Processed Products

From observation it seems that the principal processed citrus products of Algeria are juice products. None of the plants seen in Algeria had any concentrating apparatus in operation, and there does not appear to be any interest in concentrates at this time. Some peel and pulp products are produced, and there is some utilization of citrus peels as cattle feed.

Table 20. - Analysis of canned citrus juice produced in Algeria

Analysis category	Unit	Orange	Tangerine	Lemon	Grapefruit
Date of analysis		December 7, 1949	December 9, 1949	December 8, 1949	December 5, 1949
Size of can		3-7/16 x 4-5/16	2-4/16 x 2-11/16	3-8/16 x 4-6/16	No. 2 1/2
Fluid measure	Fluid ounces	19	4.2	9.5	27.5
Vacuum	Inches	10	13	17	None, dented can
Density	Degrees brix	12.14°	11.9°	10.3°	10.1°
Anhydrous citric acid per 100 ml.	Grams	1.4	0.89	6.15	1.58
Pulp	Percent	14		12	5
Recoverable oil by volume		None		None	Trace
Ascorbic acid per 100 ml.	Milligrams	53.13	20.91	47.82	23.2
Color		Good, light yellow-orange	Good, deep orange	Slightly brown tint	Fair, slightly brown
Absence of defects		Markedly free	Very free except few small pieces of enamel lining	Very few	Practically free
Flavor		Fair, sharp	Very good	Strong oxidized terebinthic flavor, very sharp	Poor, acid and strong terpine flavor
Ratio of soluble solids to citric acid		8.7:1	13.35:1		6.4:1
United States grade		C or Standard	A or Fancy	Offgrade	D or Substandard
Comment		Grade account of flavor and ratio of soluble solids to acid.	Sample too small to run pulp and oil analyses. Pulp appeared to be normal and the flavor would indicate that recoverable oil was not excessive.	Offgrade account of flavor.	Grade account of high acidity and ratio of solids to acid

Tested by Standardization and Inspection Division, Fruit and Vegetable Branch, Production and Marketing Administration of the United States Department of Agriculture.

At present, orange, tangerine, lemon, and grapefruit juices are canned commercially in Algeria. Samples of the products were obtained from plants and markets, and an analysis was made of these in Washington by the Standardization and Inspection Division of the Fruit and Vegetable Branch of the Production and Marketing Administration of the Department of Agriculture. Table 20 gives the results of tests on four juices which are now being produced in Algeria.

Market for Algerian Processed Citrus

Most of the single-strength juice preserved with sulfur dioxide and packed in paraffin-lined casks is sold to the United Kingdom, but some is shipped to France, where it is also used in the squash industry. The canned single-strength juices which are flash-pasteurized are sold exclusively in France and in the metropolitan centers of Algeria. Algerian juice products were not seen in other Western European markets.

A Visit to a Processing Plant

In 1949 a visit was made to a processing plant where processing was being carried on in conjunction with fresh fruit packing. Fruit in poor condition was first sorted by hand outside the packing houses. The spoiled or damaged fruit was picked out, and the fruit suitable for processing was carried by hand to the processing plant in wicker baskets.

Tangerine juice is canned, as well as orange juice. The fruit is peeled by hand and then prepared for juicing. This work is done by children, who are paid about 25 francs per hour ($0.08). The peeled fruit is placed in a press to extract the juice.

At the time of the visit, juiced half-sections of grapefruit were being prepared as a sample shipment of pulp. The half-sections of grapefruit were placed upon a cutting board and cut into three pieces which were placed in 100-gallon wooden casks. Water and sodium sulfite were added to this. The pulp would probably be made into marmalade.

For processing, the fruit is dumped from hampers into the washing machine and, after drying, is carried by conveyor to a machine which slices it in halves. The halves of fruit are carried down a conveyor in front of the juicing machine, which has 6 or 8 turning juice reamers on each side, similar to electric home juicers. An operator, standing at each of these stations, picks up a half of fruit by hand and places it on the reamer to extract the juice as one would in his home kitchen. The juice is carried away by pipes, and the juiced rind is placed on another conveyor which takes it out of the packing house. The juice is carried through a screw filter. After filtering, it is deaerated under vacuum and flash-pasteurized at 97° C. (207° F.). It is then cooled to 80° C. (176° F.), and the steam-sterilized cans are filled and capped by machine. The filled cans are then again sterilized by steam at approximately 102° C. (216° F.). The cans are then cooled to approximately 50° C. (122° F.), dried and labeled, and placed in the case. The cases are of wood, and are imported from France. The count per case is eight 3-liter cans or 40 No. 2 cans. In the No. 2 can size, the cost of the can and the case in 1949 was 17.5 francs ($0.05) per can. The cans are also imported from France.

The capacity of this plant was 1,000 liters (264 gallons) an hour.

General

The processing equipment now installed in Algeria seems quite adequate considering the length of the season and the small volume of fruit. It is estimated that no more than 250,000 boxes of fruit per year are processed in Algeria at this time. No efforts to advertise or merchandise the canned juice products were observed in either Algeria or France. And since the French consumer has a traditional dislike of canned goods and also prefers to eat citrus fruit out of hand and fresh, there is considerable resistance to the introduction of these new juice products. Storekeepers interviewed in French markets indicated that juices did not sell readily. The present processing capacity in Algeria is probably in excess of the amount of juice which can be sold profitably.

Conclusions

The citrus-producing acreage in Algeria has been increasing rapidly in the last 10 years with emphasis primarily on the planting of oranges. From observation it would seem that this increase in planting may be expected to continue at least for the next few years, and extensions in the planting of both lemons and grapefruit, and to a lesser extent in tangerine acreage, may also be expected.

Discounting the possibility of climatic disaster to citrus groves, it is possible that Algeria may produce 11.25 million boxes of citrus by the 1960-61 season. Frost, flood, or the hot desert sirocco winds could radically change this forecast, as could citrus diseases such as quick decline or mal secco.

Because of the varieties of citrus produced, primarily early and blood varieties in oranges, Algeria will probably continue to dispose of most of its fruit in the fresh form. The quantity of processed citrus products may increase in the next few years, but it seems unlikely that processing could be profitably expanded beyond its present capacity.

The most important costs to the Algerian citrus industry are transportation costs and those which involve imported material, such as box shooks, machinery, and chemicals. Low labor costs keep the cost of operating citrus groves at moderate levels. The costs of packing the fruit in the box, including the cost of the container and transportation to port, may be three times the cost of growing the fruit itself, while the freight from Algiers to Paris plus reasonable handling charges is approximately equal to the break-even costs of the packed fruit f.o.b. Algerian ports.

As Algerian orange production increases, it will be important to develop export markets in addition to France. This will involve some changes in the Algerian citrus industry and make necessary the wrapped packing of oranges. The new grower-owned, on-the-farm citrus packing houses also have yet to be proved on large-scale operations. At present the marketing of Algerian citrus fruits is going through a period of change, and the industry has yet to meet severe competition.

If increases in citrus production make export and marketing difficult, the domestic prices of citrus in Algeria will no doubt decline to approximately one-half the prices common in recent years, and domestic consumption can be expected to increase. However, the potentialities of the domestic market will not be known until such price reductions take place. It is possible that oranges could be sold profitably in Algerian markets at a retail price of 15 francs per kilo ($0.02 per pound).

By changing from a tangerine-producing country to an orange-growing one, Algeria may in the near future become an important supplier of citrus fruits to Western Europe. Its importance as a citrus supplier cannot be determined, however, until Algeria demonstrates that it can meet foreign competition successfully in European markets.

II. THE CITRUS INDUSTRY OF FRENCH MOROCCO

French Morocco is a country of great contrast between the old and the new. It is far more primitive than Algeria, and the advent of westernization seems to have been more recent and to have influenced the general character of the country less than it has in Algeria. Since Morocco is not a part of France, it has seemed to many to offer better opportunities than other areas of North Africa. For this reason there has been a great influx of French and other foreign capital which has hastened the development of the country. Casablanca is a modern, rapidly developing town, with a large business district and a developing industrial area along the coast. This trend toward modern development is also taking place in other cities such as Rabat, Port Lyautey, and Fedala. But the changes are not so marked in these latter cities. Rabat is a very colorful and pleasant city located close to the sea on sloping hills. Its white houses and colorful bougainvillea are reminiscent of some of the districts in California near San Diego.

There is a great building boom going on in French Morocco. It is particularly evident in Casablanca where modern apartment houses and office buildings are being erected in great numbers. Nearby, the characteristics of the native Morocco still go on comparatively untouched by change. Camel caravans pass by show windows where crawler tractors and other mechanical and industrial equipment, primarily of American design and manufacture, are on display.

The land holdings in Morocco which are cultivated by Europeans are usually extensive and utilize the most modern cultivating equipment.

Citrus fruits were introduced into Morocco during the 9th century and have been cultivated to some extent by Moroccans ever since. The European plantings were started in 1921. Since that time the cultivation of citrus fruits in Morocco has developed considerably as the following figures indicate:

1935 - 4,000 hectares (of which 1,200 were native plantings)
1938 - 7,400 hectares (of which 1,800 were native plantings)
1946 - 15,000 hectares (of which 3,000 were native plantings)

According to Moroccan records, by 1938 the number of citrus trees had reached 1,547,000, and by 1946 there were 3,970,000 trees of which 2,200,000 were in full production. By 1948 this had increased to a total of 4,400,000 trees, and of this total more than a million trees were the property of native Moroccans. While there has been some increase in the holdings of native Moroccans, the big increase in citrus plantings has been in those plantations operated by Europeans.

Table 21. - French Morocco: Number of citrus trees, 1918, 1922, 1928, 1932, and 1935-48

Year	Native orchards, number of trees	European orchards, number of trees	Total number of trees
1918....	92,285	11,272	103,557
1922....	109,308	15,491	124,799
1928....	177,045	32,640	209,685
1932....	270,233	197,675	467,901
1935....	354,418	576,410	930,828
1936....	383,541	727,277	1,110,818
1937....	460,619	878,643	1,339,262
1938....	513,713	1,033,433	1,547,146
1939....	564,000	1,606,000	2,164,000
1940....	....	....	2,483,760
1941....	676,629	2,160,424	2,837,053
1942....	....	....	3,216,123
1943....	780,017	2,538,418	3,318,435
1944....	848,332	2,654,393	3,502,725
1945....	898,702	2,677,781	3,576,483
1946....	1,015,390	2,954,579	3,969,969
1947....	1,047,931	3,047,200	4,095,131
1948....	1,147,520	3,284,506	4,432,026

Source: Service de l'Horticulture, Rabat, Morocco.

Acreage

The 1943 census of citrus plantings in French Morocco indicates clearly the nature of the citrus industry as well as the pattern for future development. Early varieties of oranges predominated in 1943, both among trees bearing at that time and among the young plantings which were not yet in bearing. The acreage planted to lemons, grapefruit, and other citrus was very small in comparison with the acreage planted to oranges and clementines. Clementines, which comprised nearly one-fourth of the citrus acreage in 1943, are included with oranges. In French Morocco it is quite proper to consider the clementine acreage as a part of the orange production since the majority of the oranges are early varieties of approximately the same season as the clementine, and the clementine trees are being top-worked to orange varieties in a great number of orchards because of the erratic bearing habit of the clementine.

The Moroccan citrus industry is growing very rapidly as is indicated by the acreage figures for 1943, 1948, and 1949 (tables 22-24). The total citrus acreage increased from nearly 27,000 acres in 1943 to between 44,000 and 47,000 acres in 1949. The top-working of the clementine variety reduced the acreage of that fruit by approximately 1,000 acres in the 6 years. The acreage of tangerines, lemons, and grapefruit increased percentagewise, but the total acreage is still rather small. The largest increase during this period was in orange acreage. The 1949 plantings were predominantly early oranges; however, there has been an increasing interest in late and midseason varieties.

Early varieties have been emphasized in French Morocco because the normal season is approximately 3 weeks earlier than that of Algeria, and Moroccan growers are, therefore, able to take advantage of higher opening prices. Recently, interest has been shown in late variety fruit which matures during the spring at the end of the season for blood oranges and before the Spanish and Algerian Valencia Late and Verna 1/ oranges are ready for the market. Since white (nonblood) oranges are in short supply on the European market at this time, late varieties of oranges from Morocco can be sold to advantage.

Table 22. - French Morocco: Census of citrus plantings (European orchards), by kind, 1943

Kind of citrus	Number of trees				Acreage			
	Bearing	4 to 6 years	1 to 3 years	Total	Bearing	4 to 6 years	1 to 3 years	Total
	1,000	1,000	1,000	1,000	Acres	Acres	Acres	Acres
Oranges:								
Early....	395	300	125	820	4,880	3,707	1,544	10,131
Midseason	120	110	81	311	1,482	1,359	1,001	3,842
Late.....	43	85	68	196	532	1,050	840	2,422
Subtotal	558	495	274	1,327	6,894	6,116	3,385	16,395
Tangerines	75	30	17	122	927	370	210	1,507
Clementines	360	130	135	625	4,448	1,606	1,668	7,722
Lemons.....	30	10	6	46	371	124	74	569
Grapefruit	9	2	3	14	111	25	37	173
Others.....	15	15	7	37	185	185	87	457
Subtotal	489	187	168	844	6,042	2,310	2,076	10,428
Total citrus	1,047	682	442	2,171	12,936	8,426	5,461	26,823

Source: H. Rebour, Les Agrumes en Afrique du Nord, Algeria, 1945.

1/ Also called Berna in Spain and Vernia and Bernia in North Africa. The Verna is a late nonblood orange.

Table 23. - French Morocco: Citrus acreage by district and by kind, 1948

District	Acres	Kind of citrus	Acres
Sous	3706.5	Clementines	7413.0
Marrakech	2471.0	Tangerines	1235.5
Casablanca/chaouia	3706.5	Oranges	
Rabat/Rharb		(Washington Navel)	19768.0
(Sidi Slimane)	22239.0	Oranges	
Meknes	4942.0	(Midseason)	6671.7
Fez (Northern part)	2471.0	Valencia Late	7413.0
Oudjda (Berkam)	4942.0	Grapefruit	247.1
Total	44478.0	Lemons	1235.5
		Miscellaneous	494.2
		Total	44478.0

Source: Syndicat General Marocain des Producteurs d'Agrumes.

Table 24. - French Morocco: Estimated citrus area, by kind, 1949

Kind of citrus	Acreage
	Acres
Oranges:	
Early	16,309-16,803
Midseason	8,648-9,884
Late	7,413-8,648
Other	1,236-1,236
Subtotal	33,606-36,571
Clementines	6,672-6,672
Tangerines	1,977-1,977
Lemons	1,359-1,359
Grapefruit	494-494
Total citrus	44,108-47,073

Source: Lexique de l'Economie Marocaine, 1949.

Production

The rapid growth of citrus production in French Morocco since 1935-36 is shown in table 25, and the growth of orange production is further illustrated in the accompanying chart. The increase in the production of oranges has been consistent except for a slight interruption in the war years of 1941-42 and 1942-43 when there was a slight decrease. Production reached nearly 5 million boxes in the season of 1950-51, compared to 1.4 million boxes in the 1940-41 season.

The production of lemons, which is a minor crop, followed a similar trend, and the 1950-51 production of nearly 93,000 boxes was over three times the production of the 1940-41 season.

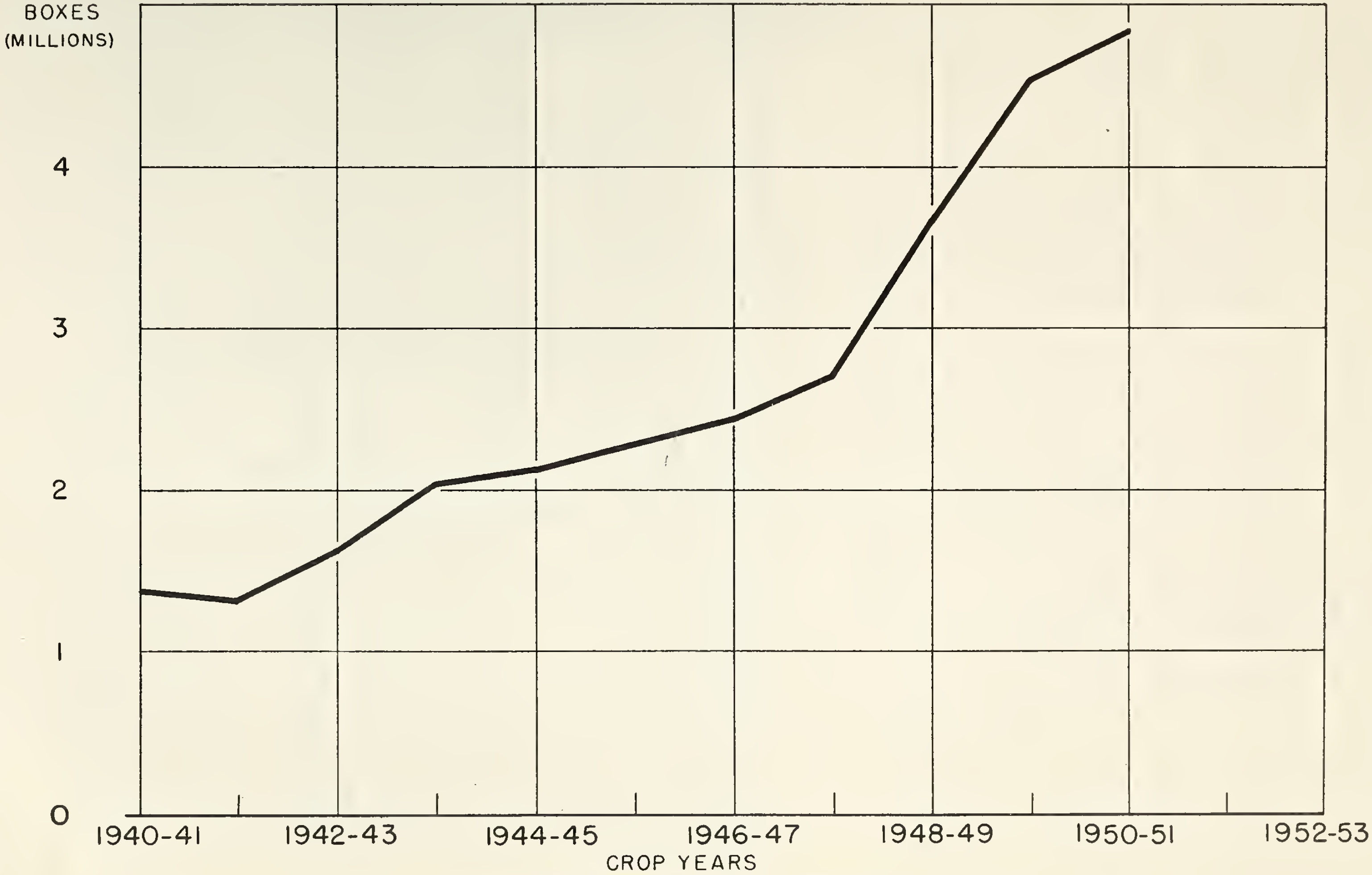
Grapefruit production increased markedly in this 10-year period--from about 13,000 boxes in 1940-41 to over 82,000 boxes in 1950-51.

In table 26 the production of citrus in French Morocco by types is given in more detail for the period from 1947-48 to 1950-51. The clementine and tangerine have never been of major importance in French Morocco, and the comparative importance of these varieties is decreasing as total citrus production increases. Total clementine and tangerine production which was approximately one-third of orange production in 1940-41, was only about 10 percent of orange production in 1950-51 owing to the rapid increase in orange production during this period.

Citrus production in French Morocco will continue to increase in the next 10 years as new acreage comes into production. Oranges will be the most important type produced, and total orange production including clementines and tangerines may reach 10 million boxes per year by 1960. This will be predominantly oranges. Considerable clementine acreage is being top-worked to orange varieties since the clementine has been found to be an erratic bearer, and total tangerine and clementine production is not likely to exceed 750,000 boxes per year by 1960. The production of lemons may also be expected to increase, and it may reach 250,000 boxes per year by 1960. An increase in grapefruit production may also be anticipated, and a total production of 150,000 boxes per year in 1960 would be plausible. The increase in production of this variety is not as assured as that of lemons or oranges. European markets have recently been well supplied with grapefruit and if surpluses occur grapefruit trees may be top-worked to other more profitable varieties.

French Morocco has the most rapidly growing citrus industry in North Africa, and perhaps in the world. In 10 years, when this industry reaches a more mature status as the new acreage comes into production, French Morocco will be one of the major Mediterranean orange-supplying countries. This new orange production from French Morocco will largely compensate for the decrease in orange production which has taken place in Spain in the last 15 years.

FRENCH MOROCCO: PRODUCTION OF ORANGES,* 1940-41 - 1950-51



**INCLUDING TANGERINES AND CLEMENTINES*

U S. DEPARTMENT OF AGRICULTURE

NEG. 1763 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Government viewpoint in 1949. Moroccan Government officials express the opinion that citrus plantings are increasing at the rate of approximately 1,000 hectares (2,471 acres) a year. Before the war, primarily early varieties were planted; however, the present trend is toward late varieties. There is already some discussion regarding the limitation on the planting of new acreage, but the Government believes that additional production will be necessary, both for export and to meet the demands of the rapidly increasing population.

The Monet Plans envision 100,000 hectares (247,100 acres) of citrus in all French territories: 50,000 hectares (123,550 acres) for Morocco; 40,000 hectares (98,840 acres) for Algeria, 2,000 hectares (4,942 acres) in Tunisia; and 8,000 hectares (19,768 acres) in French Guiana. It is believed that it will take 10 to 20 years to accomplish this goal, and it is planned that surplus supplies will be made available to French West and Equatorial Africa. It is the Government's opinion that at a price of 10 francs per kilo ($0.014 per pound) in the field the average grower will about break even and that a price of 12 francs per kilo ($0.017 per pound) will permit a small profit,

Table 25. - French Morocco: Citrus production by type 1935-36 to 1950-51.

Season	Oranges (incl. clementines and tangerines)	Lemons	Grapefruit
	Boxes	Boxes	Boxes
1935-36....	609,729	11,603	6,614
1936-37....	823,135	15,664	8,929
1937-38....	917,594	17,405	9,921
1938-39....	1,067,027	20,306	11,574
1939-40....	1,219,459	23,206	13,228
1940-41....	1,371,891	26,1[illegible]7	14,881
1941-42....	1,310,918	24,947	14,220
1942-43. ..	1,615,783	30,748	17,527
1943-44....	2,042,594	38,871	22,156
1944-45....	2,134,053	40,611	23,148
1945-46....	2,286,4[illegible]5	43,512	24,802
1946-47....	2,438,[illegible]18	46,413	26,455
1947-48....	2,708,509	72,520	41,336
1948-49....	3,653,338	58,016	55,115
1949-50....	4,535,178	87,023	82,672
1950-51....	4,837,523	92,825	82,672

Source: Official sources.

Table 26. - French Morocco: Citrus production by types, 1947-48 to 1950-51

Type	1947-48	1948-49	1949-50	1950-51 1/
	Boxes	Boxes	Boxes	Boxes
Oranges:				
Early	2,047,129	1,732,186	2,047,129	2,141,612
Midseason	283,449	850,346	1,102,300	1,068,286
Late	151,172	661,380	881,840	1,073,325
Clementines	188,966	314,943	377,932	403,127
Tangerines	37,793	94,483	125,977	151,173
Total, oranges	2,708,509	3,653,338	4,535,178	4,837,523
Lemons	72,520	58,016	87,023	92,825
Grapefruit	41,336	55,115	82,672	82,672

1/ Preliminary estimate

Source: Official sources.

Topography, Climate, and Soils

Topography

The coastal region of Morocco is a vast plain, 200 miles wide at some points, lying between the Atlantic Ocean and the Atlas Mountains. In this range, peaks of over 10,000 feet are common, and a great watershed extends along the coastal side of the mountains toward the Atlantic. Intensive agriculture such as citrus production is practiced in the regions where water may be obtained by gravity and pumping, and the remaining agricultural area is devoted to grazing and the dry farming of cereals.

The Atlas Mountains are further inland in the southern section of the country than they are in the northern areas east of Rabat.

French Morocco may be divided into three geographical sections. The southernmost is the desert area, which lies on the desert side of the Atlas Mountains and is accessible through the Atlantic port of Agadir. This district has been of minor importance agriculturally; however, in the valley of the Sous there is a growing agricultural industry, including some plantings of citrus.

In the northeastern section of French Morocco is another small citrus area in the vicinity of Oudjda, near the Algerian border. Access to this region is gained through the Algerian port of Oran. The Atlas Mountains separate these two areas from the main portion of French Morocco, which is the vast plain referred to above and which is the richest and most populous area. This plain is accessible to the Atlantic seaports such as Casablanca.

Climate

In the citrus districts of French Morocco there are four climatic zones: the desert areas of Marrakech and the Sous; the coastal area in the vicinity of Casablanca and Rabat; the northern citrus districts inland from Rabat on the valley floor near Sidi Slimane; and the district still further inland in northern Morocco in the vicinity of Meknes, which includes the watercourse culture in the same area, particularly that along the Oued Ouergha.

Southern Desert Citrus Climatic Zones (Marrakech). The climate of Marrakech is dry and hot in summer with a period of winter rains from October to April. Normal rainfall will average 8 to 11 inches a year. The region is subject to periods of drought, and growers report that 1942 to 1948 was a very dry period during which there was little rainfall. The climate seems to be similar to that of the Coachella and Imperial Valleys in California and to that of the Arizona citrus district in the Salt River Valley. The climatic hazards are the hot sirocco winds, which occasionally blow from the Sahara, and hail in the springtime. In both 1948 and 1949 hail storms damaged groves in April. The hail storm in 1949 was severe with hail stones as large as a half inch in diameter. It partially defoliated trees, damaged some of the fruit remaining on the trees, and split small limbs making wounds an inch or more in length. Killing frosts are said to be unknown at Marrakech. However, on cold winter mornings growers state the temperature may fall to 30° to 32° F. for short periods. This is desert country except in the isolated localities where there is a natural watercourse or irrigated land. The climate is suitable for the production of citrus, olives, dates, and apricots.

As to geographic location, Marrakech is approximately 160 miles inland from Casablanca on the coastal plain at an elevation of approximately 1,200 feet. It is located at the foot of the Atlas Mountains, which extend from Agadir eastward to the vicinity of Taza. The snow-capped Atlas Mountains form a background for Marrakech and a vast watertable for the valley floor. The highest peaks in the vicinity are over 12,000 feet.

The other desert citrus districts, such as those in the valley of the Sous, are reported to have a similar climatic condition but generally a lower rainfall than is the average at Marrakech.

Coastal Citrus Climatic Zones (Casablanca and Rabat). The scattered citrus plantings in this area all lie within a climatic belt 10 miles from the seacoast. The rainfall in this coastal belt averages about 15 inches per year, and the climate is quite humid. In summer this region is much cooler than the inland districts. The cool air from the Atlantic Ocean mixes with the heated air from interior Morocco, causing summer fogs.

Northern Valley Citrus Districts (Sidi Slimane and Petitjean). This climatic zone lies about 50 miles inland from Rabat on a relatively low coastal plain with a humid climate and a relatively high winter rainfall which may reach a maximum of 36 inches per year. This is relatively level land, and orchards may be planted with little cost for leveling.

This area is sufficiently far inland to be out of the coastal fog belt. The runoff in this area is rather slow and the rivers follow a slow winding course to the Atlantic Ocean. In the area of Sidi Slimane and Petitjean lie the largest and most important citrus plantings in French Morocco.

Northern Elevated Citrus Districts (Meknes, Fes, and the Oued Ouergha). The citrus districts in the vicinity of Meknes, Fes, and the Oued Ouergha are located on higher ground and have a dry summer climate. Most plantings are on level delta land adjacent to watercourses (oueds) 2/, and near hilly or mountainous terrain. In wintertime, heavy rainfall in the mountains may cause floods, and orchards visited on the Oued Ouergha were flooded in the spring of 1949 with water reaching a depth of 6 feet in some orchards. Although these floods break some trees and deposit silt which adds to the problems of keeping ground level for irrigation, the groves which had been flooded were in a vigorous condition in August, bearing an excellent crop of fruit.

The summer temperatures are high in these citrus districts, sometimes reaching a maximum of 115° F. in the shade. When this heat is carried by the desert sirocco winds, it will burn the fruit and leaves on the tree regardless of the moisture content of the soil.

In high northern Morocco citrus districts damage from hail is occasionally experienced in the spring as it is at Marrakech. Growers report that killing frosts are unknown.

Because of the high summer temperatures, the citrus of Morocco is 2 to 3 weeks earlier than that of Algeria; this encourages a specialization in early varieties such as the clementine and Washington navel.

General. Climatic data by month is not available for all representative French Moroccan citrus areas. However, in tables 27 and 28 data on three representative districts are presented. Rabat and Casablanca are representative of the coastal district; Marrakech is representative of the desert citrus areas; and Meknes is representative of the higher northern citrus districts. Although Meknes is in the northern elevated citrus districts, it is not representative of the climatic conditions along the Oued Ouergha. Rainfall along the Ouergha is considerably higher than that at Meknes since the Ouergha river winds through a mountainous northern region and is the primary source of drainage for a large area. Rainfall on the Ouergha may reach over 24 inches per year, and may be exceedingly heavy at certain times.

2/ Pronounced "wed."

Table 27. - French Morocco: Average minimum and maximum temperature by months

Month	Rabat		Meknes		Marrakech	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Degree F.	Degree F.	Degree F.	Degree F.	Degree F.	Degree F.
January	46.6	64	39.2	63.0	41.0	68.0
February	48.7	66.2	42.8	68.0	46.0	75.0
March	48.7	65.0	44.0	64.0	46.6	73.4
April	49.0	73.4	50.0	76.0	55.0	87.0
May	54.0	73.4	53.0	80.0	58.0	90.0
June	57.0	76.0	54.0	86.0	60.0	91.0
July	60.0	85.0	60.0	98.6	69.0	105.8
August	62.6	82.0	59.0	93.0	68.5	102.2
September	60.0	80.0	54.0	86.0	63.0	89.0
October	59.0	75.0	53.0	76.0	59.0	80.0
November	58.0	74.0	52.0	72.0	55.0	78.0
December	50.0	67.0	41.0	62.6	46.0	68.0

Source: Annuaire de Statistique Generale du Maroc, 1937.

Table 28. - French Morocco: Average rainfall by months

Month	Casablanca	Meknes	Marrakech
	Inches	Inches	Inches
January	1.9	2.7	1.1
February	2.0	3.1	1.2
March	2.4	3.2	2.0
April	1.5	2.3	0.9
May	0.7	1.2	0.8
June	3.0	0.8	0.5
July	0.0	0.08	0.04
August	0.0	0.08	0.3
September	0.4	0.4	0.3
October	1.2	0.8	0.7
November	2.8	1.9	1.9
December	2.7	1.1	1.1
Total	15.9	17.7	10.8

Source: Annuaire de Statistique Generale du Maroc, 1937.

Not represented in the climatic data is the area of Sidi Slimane which is the most important citrus area in French Morocco. The temperature conditions are somewhat similar to those at Meknes; however, Sidi Slimane has a more humid climate and a considerably higher rainfall.

These climatic data are average minimum and maximum temperatures and, therefore, do not indicate the absolute range in temperature.

Table 28 indicates the influence of climate upon maturity of citrus varieties.

Table 29. - French Morocco: Calendar of citrus production

Month	Clementines	Navel oranges	Cadenera	Tangerines	Blood oranges	Grapefruit	Moroccan 1/	Verna	Valencia Late
October	x								
November	x	x							
December	x	x	x	x					
January		x	x	x	x	x			
February		x	x		x	x			
March					x	x	x	x	x
April						x	x	x	x
May								x	x
June									x

1/ Local orange varieties, a group.

Source: Office Cherifien de Controle et d'Exportation, Casablanca.

The Moroccan citrus districts are located in a climatic zone exceedingly favorable to the production of citrus. The winter hail storms and the hot Morocco winds, seem to be the two greatest climatic hazards. Since extensive citrus plantings are recent in Morocco, it will require at least 20 years to evaluate the long-range climatic hazards, particularly frost. Some districts which appear to be frost-free may not prove to be so over a period of years.

Soils

Soils of French Moroccan citrus districts differ from those of Algeria, in that they apparently contain more sand and have better drainage. The Moroccan soils are dominantly red and brown, but there is some variation between the districts. In the desert region, such as in the vicinity of Marrakech, a portion of the soil is a sandy loam. The same condition is found in some of the northern Moroccan citrus districts where the orchards are planted adjacent to watercourses. This is all alluvial sand and would be termed a light loam. Some of these soils along watercourses are very light, having a high percentage of sand.

In the coastal area, in the vicinity of Rabat, drainage appeared to be excellent. Here, it was found possible to walk through an irrigated orchard even while the soil was wet---this would not have been possible in the red soils of Algeria.

Citrus Districts

The citrus districts of French Morocco may be roughly divided into two parts, those lying north of Rabat and those south from Casablanca. These districts generally differ climatically. Those in the north tend to be more humid and produce fruit which growers claim does not have as good shipping qualities as the fruit from the southern districts.

Southern Citrus Districts

The southern citrus districts are widely scattered and may be roughly outlined as follows: 3/

Marrakech. The plantings at Marrakech are divided into two distinct classes: (1) the European orchards which are planted by modern methods and tilled by mechanical means; and (2) the native groves which are tilled by hand or by horse-drawn implements and are not cultivated in a commercial manner. The trees in these native groves may not be planted in rows; varieties are mixed and many trees are unbudded seedlings. Native plantings north of the town and adjacent to the river are usually surrounded by stone walls as is customary with Arab gardens. In some of these gardens date palms have been interplanted with citrus, as is done in some grapefruit groves in the Coachella Valley in California.

The district at Marrakech will be important commercially, as it is located at a railroad head and has modern packing equipment, one installation of which was furnished by an American firm. Marrakech is an ancient walled town located at an oasis at the foot of the coastal side of the Atlas Mountains adjacent to the Oued Tensift. This town was formerly the residence of the Sultan of Morocco, and the Sultan's gardens contain citrus trees which are apparently 60 to 75 years of age. Commercial citrus plantings lie east and west of the city south of the river.

Another small citrus district is reported halfway to the coast between Marrakech and Mogador near the town of Chichaoua on the river of the same name.

Two other citrus districts are located east of Marrakech. One is reported 50 miles away at El Kelaa. Farther along this road about 75 miles is another citrus area reported at Beni Mellal. Beni Mellal is said to be potentially important, possessing excellent climatic and soil conditions and an abundant water supply.

3/ See table 23 for comparison of acreage of citrus districts.

Across the Atlas Mountains on the road toward Agadir is the region of the Sous. A very young citrus district in which grapefruit is found to do exceptionally well is reported along the Oued Sous. This district extends west from the town of Taroudant for approximately 25 miles. The Sous is on the Sahara side of the Atlas Mountains, and fruit from this district is shipped from the port of Agadir. Farther south along the coast approximately 50 miles from Agadir is reported a still newer district along the Oued Massa near the town of Agdal Oumerzgoun. All of the regions in the Sous consist of young plantings and in some of the districts mentioned the present acreage is rather small. Marrakech is the only southern district having railroad transportation, and the intensive development of the southern districts such as those near Agadir will largely depend upon development of transportation and port facilities. The southern location of Agadir will probably make refrigerated transportation desirable for best commercial transportation.

Northern Citrus Districts

As is the case with the southern citrus districts, those in the north are widely scattered, and they may be described as follows:

Rabat (Coastal Region). There are a few small plantations, each isolated from the other, along the coast mostly within 2 miles of the sea between Rabat and Port Lyautey. As is the case with all southern districts, these are surrounded on all four sides by windbreaks consisting of cypress trees, and water is supplied entirely by pumping.

Sidi Slimane. The largest and most important citrus plantings are found inland from Port Lyautey at Sidi Slimane. The principal groves lie parallel to the highway east and west of Sidi Slimane and north and south along the Oued Beth. The striking thing about this district is the great vigor of the trees and the very high production of fruit per acre. The groves observed in this region would be equal to the best in citrus culture anywhere in the world. A very large percentage of the groves are less than 5 years of age and large acreage may be expected to come into bearing in the next 5 years. This district is on the floor of a relatively level valley and typical of what may be termed "Moroccan valley culture."

Meknes-Petitjean (Oued Rdom). The commercial citrus district between Petitjean and Meknes has a very different culture from that of the valley. The groves in this region are what may be termed "typical oued culture" in that they are located on relatively small level places adjacent to the winding watercourse which connects Meknes and Petitjean. Since the land which can be utilized in this manner is limited by the terrain there is little likelihood that present plantings can be greatly expanded in this area. As in other citrus areas the groves have not reached full bearing, and many young plantings were observed.

Meknes-Fes. Citrus plantings of a valley-type culture were observed on the relatively high plateau between Meknes and Fes. Plantings lie parallel to the highway but all of importance are north of the railway. All citrus districts mentioned thus far lie adjacent to the main railway line which connects Rabat and Oran.

Oudjda. Along the railroad to the east is another commercial citrus district in the vicinity of Oudjda. This is reported to be typical valley-type culture.

Oued Ouergha. North of Fes towards Ain-Aicha is the Oued Ouergha, and along this river to the west are citrus plantings of a typical oued culture in the vicinity of Ourtzagh. This river lies in a great valley; the rolling hills on either side have underground water supplies at frequent intervals, and it is possible to raise corn during the arid summer on the hill slopes without irrigation. Ten-year old orchards were observed which had never been irrigated until 1949. The groves seemed in excellent condition, which is remarkable in view of the very hot, arid Moroccan summer. Farther west, large plantations are found in the vicinity of Fes el Bali. Towards Khemichet where the valley widens are other large new citrus plantations with on-the-farm packing plants.

East of Fes el Bali a large dam is to be built which will impound water to irrigate vast areas of land, and thus a new, rich agricultural region highly favorable to citrus will be added to Moroccan agriculture.

Cultural Practices

The European-owned citrus properties are all large, usually 100 acres or more.

As in Algeria and Tunisia, commercial plantings are scattered. Each planting is surrounded by a windbreak, but the wind hazard is apparently less in Morocco than in other areas, for windbreaks are more widely separated.

Commercial groves observed were comparable to United States culture, having concrete irrigation systems and orderly plantings at distances of 20 to 25 feet. Trees are budded quite high, approximately 12 to 18 inches from the ground, and sour orange stock is used exclusively.

As in other areas of North Africa, labor is furnished by the large native population which provides great quantities of unskilled, rather inefficient labor. European operators who have attempted to stimulate native interest in permanent employment by wage incentives are said to have been disappointed.

In this discussion of the cultural practices in French Morocco general observations will be made for the industry as a whole with occasional remarks on unique practices in specific areas. Only the European-operated groves will be discussed, since most of the native plantings do not produce fruit of a type which enters into international trade. In the European citrus groves the unit of land measure is the hectare (2.471 acres).

Windbreaks and Planting Distance

At Marrakech the European groves are planted on modern United States design with the distance between trees approximately 20 to 25 feet. Each orchard is protected by a windbreak, which is usually composed of Italian cypress trees, but sometimes of cane or eucalyptus. These windbreaks are necessary to protect plantings from the scorching sirocco winds, and they are planted about every 325 feet across the usual wind direction or approximately every thirteenth tree row. These windbreaks use considerable orchard space.

The average number of citrus trees per hectare will range from 178 to 200 (72 to 81 trees per acre). These growers tend to be generous in the use of land, leaving ample distance for grove drives and a generous margin around the groves for windbreaks.

Land to be utilized as groves must first be reclaimed from its natural state by removal of any brush and by leveling to permit irrigation. It was observed that windbreaks are first planted around the area to be developed, and then the land is leveled by bulldozers.

In well-operated groves, cane had been planted in the bottom of small natural watercourses through the undeveloped land to hold the soil in place and prevent erosion. The valley plantings are all surrounded with windbreaks composed of Italian cypress, but in northern Morocco some of the oued plantings which are protected by hills do not have windbreaks.

Cultivation

In European-type-cultivated orchards in French Morocco cultivation is carried on in all districts primarily with crawler tractors equipped with disks. Disks are also used for drawing up borders for irrigation. Rubber-tired wagons and trucks are used for hauling light implements and spray equipment.

As in California, "Bermuda" grass and "nut grass" are orchard pests. The soil is heavy in most districts, and, even though it may have good drainage, it seems necessary to use heavy implements and to cultivate deeply. The use of heavy implements often creates a plow sole, and it is necessary to use a subsoiler down row middles. A subsoiler is also used between the first row of trees and the windbreaks to destroy competitive windbreak roots.

The cultivation methods in French Morocco seemed excellent. It apparently is the practice to cultivate after each irrigation in summer, probably due to the high temperatures which would cause the moisture to be drawn from the soil very rapidly if weeds were allowed to grow. In some north Moroccan citrus districts winter cover crops are grown, however.

The only hand cultivation observed in Morocco was the usual hoeing around newly planted trees.

One orchard at Marrakech had a small section which was being operated as an experiment with a permanent turf cover. This was operated without the use of any tillage, and grass and weeds were destroyed only once a year by the use of an oil spray. The trees in this area seemed healthy and vigorous and quite comparable to those in the cultivated area.

Irrigation

In northern Morocco on the great plain where the rivers follow a slow, winding course to the Atlantic, there is considerable area which is adjacent to a source of gravity water for irrigation. However, as a general practice, irrigation water in Morocco is obtained by pumping.

Irrigation water is applied by several methods. In the district of Sidi Slimane and in the higher oued plantings, water is applied by the use of furrows. In other northern districts, where plantings are near watercourses, all types of irrigation were observed; irrigation water is frequently pumped directly from the rivers, but the majority of plantings have an orchard distribution system of concrete pipe. In areas with relatively light soil and good drainage the furrow basin method of irrigation is practiced, and nearly the entire surface of the ground is flooded.

Near Marrakech irrigation water is obtained by gravity from Atlas Mountain sources and from pumping. The majority of the old native citrus gardens are irrigated by gravity water which flows from the mountain sources underground through ancient tunneled pipelines to the oasis plantations. In the deepest point these pipelines may be as much as 150 feet underground. Irrigation water for most European plantings is pumped from wells by large oil engines which operate 24 hours a day during the irrigation season. The wells are open, stone-walled cisterns approximately 8 feet in diameter and the water depth is approximately 30 feet. Each pump will furnish 80 to 120 cubic meters (21,134 to 31,700 gallons) of water per hour. The water in most wells is said to be good; however, some wells furnish water with a high saline content.

Water is applied to the grove through dirt ditches since most plantations are still too new to have installed a permanent water distribution system. The flood basin method of irrigation is practiced, and due to high temperature it is usual to irrigate at intervals of 5 weeks. The soil in some orchards is said to have a high manganese content which leaves a deposit at the water line on furrows after irrigation. It is reported that this difficulty may be overcome by washing the soil through irrigation.

The practice of irrigation was notably better at Marrakech and in the orchards in the vicinity of Sidi Slimane than in the northern citrus districts where the orchards were planted adjacent to watercourses. In these latter areas some of the land was not properly leveled when the orchard was planted, and this condition has been accentuated by deposits of silt left by the occasional floods. Irrigation presents a problem in these orchards as it is difficult to distribute the water evenly. The low areas of the ground gave evidence that too much water had been applied and that root injury had resulted. Sprinkler irrigation would probably be more effective in these northern districts.

From observation it would seem that Morocco could improve its irrigation practice considerably.

Pruning

Pruning is usually confined to the removal of sucker growth and dead wood. Clementines and tangerines are quite heavily pruned; the trees are opened on the top in a manner similar to the practice in Spanish groves.

The pruning observed in most orange groves was similar to the generally accepted practice in United States citrus orchards.

Fertilization

Since these groves are being developed on virgin land, fertilization is not as yet a problem. The dark-colored large leaves gave evidence of the availability of adequate plant food. There is some chlorosis; however, no serious conditions were seen.

The following were the current prices for fertilization material in Morocco in 1949.

Item	Francs per kilo	U.S. dollars per pound 1/
Sulfate of ammonia	139	0.20
Nitrate of lime	201	0.28
Potassium sulfate	53	0.08
Phosphoric acid	30	0.04

1/ Converted at 320 francs to the dollar. From a report of the American Consul at Casablanca.

Growers estimated that, at these prices, an adequate application of fertilizer would cost 8,600 francs per hectare ($10.88 per acre) in 1949.

Some growers interviewed stated that light applications of manure were made on the sections of the groves where the trees had reached 12 to 15 years of age. However, it is not customary to apply manure each year.

In some of the northern Moroccan citrus districts winter cover crops are grown, and it is reported that the heavy rainfall causes extremely heavy crops of this green manure.

Nurseries and Root Stocks

It may be conservatively estimated that at least 200,000 new citrus trees are being planted each year in Morocco. In the past few years the demand for new trees has been very great, but recent nursery production has approximately met the demand. In 1949, one-year-old trees sold for 125 francs (39 U.S. cents) and two-year-old trees for 200 francs (62 U.S. cents). Prices as high as 400 francs ($1.25) per tree were also quoted.

A nursery near Rabat was found to be producing trees of excellent quality. It contained approximately 100,000 trees over 6 months of age, and was selling from 50,000 to 60,000 trees a year. It is evident from the number of unbudded seedlings that this rate of production will continue for the next few years, at least. All of the citrus was on sour orange root stock, and the primary varieties were the Thomson and Washington Navel, the Valencia Late, and some Portuguese, a semi-blood.

A smaller nursery with about 25,000 trees is operated by the same company at Meknes. The majority of trees in this nursery are still young, and there will not be any great production of budded trees until 1952.

Official statistics credit Marrakech with 1,000 hectares (2,471 acres) of trees. One plantation had two nurseries with a total of approximately 75,000 trees. At 175 trees to the hectare (71 trees per acre) this stock would plant over 400 hectares (about 1,000 acres).

It is the practice to ball trees for planting. Large plantations operate their own nurseries and sell their surplus to other growers. Navels represent a large portion of the varieties being raised; however, a local variety of sweet orange is also being propagated.

There is no method by which parent trees may be certified as free from psorosis, and, therefore, it is quite likely that present plantings will produce some diseased trees. Psorosis exists on navels and clementines in commercial groves.

Disease Control

No plan is in operation for the control of psorosis, and growers must depend on their ability to choose healty trees for scion stock. The progressive attitude of the majority of the citrus growers, however, would lead one to believe that they will soon establish a plan based on the registration of disease-free trees and the registration of all mursery stock.

Gummosis is a problem, and new outbreaks of this disease occurred in the spring of 1949 after a season of heavy winter rain. There was no evidence of other serious diseases such as mal secco, oak root fungus, or quick decline.

Since the majority of the citrus groves in Morocco are still young and growing, disease has not as yet become a factor in most groves. Generally the disease problem is greater in the more humid valley region of Sidi Slimane, with its high winter rainfall, than in the dryer regions, such as Meknes and Marrakech.

Pests and Pest Control

The major citrus pests of Morocco are California red scale, a "comma" scale, and the Mediterranean fruit fly, which is known asthe ceratit fly in this area. Marrakech is remarkably free from the usual citrus pests, and growers think the climatic conditions are unfavorable for pest development. Although scale, red spider, and mealy bug were not seen in groves, a heavy infestation of California red scale and some signs of mealy bug damage were observed on trees in the gardens of a hotel at Marrakech. This region is subject to periodic infestation of locust. In the dry years from 1942 to 1948 young citrus plantings were severly damaged - leaves were eaten, growth retarded, and as many as 25 percent of the trees were killed. The locust attack of 1942 was the first since 1929. There may be a correlation between the drought and the appearance of this pest.

The Mediterranean fruit fly is active from about July 1 to October; it is most prevalent from Port Lyautey to the Spanish Morocco border and is especially active in the Sebou River area. There are several ways in which growers attempt to control this pest. Some growers place glass traps containing a mixture of sugar and arsenate of lead in the trees, and bundles of straw saturated with this solution are sometimes hung in the tree as additional protection. At Marrakech the practice is to spray the trees four times between July and October with a mixture of molasses and arsonate of lead. The formula used is 14 kilos of molasses, half a kilo of arsenate of lead, and 100 kilos of water. Growers state that if the spray is properly applied damage can be kept to less than 3 percent even in seasons when the fly is active. In northern Morocco an attempt is made to control the fruit fly by DDT sprays in the fall. Since the Moroccan fruits are primarily early varieties, the control of the Mediterranean fly is very important. The damage varies from year to year, but it is always most severe before the first fall rains.

Scale insects are controlled by spraying and by fumigation. It is common practice to fumigate every 4 years, and no spraying is done in the year following fumigation. In the two subsequent years, one or more applications of a 2-percent white oil is used. Scale control problems are very interesting in some areas, and in at least one grove in northern Morocco it has been necessary to spray only the shaded side of the tree with an oil spray. Apparently the temperature on the sunny side of the tree was sufficiently high to accomplish a control. No copper sulphate sprays are used on citrus. Spray materials are applied by power-driven machines similar to those in United States orchards, but no towers are used.

From the costs of spraying and fumigating in Morocco in 1948 given in tables 30 and 31, it will be seen that the price of spraying depends on the size of the trees and the dosage of oil, the most important factor being the quantity of oil used. Spraying trees 1 to 4 years old with a 2½-percent mixture of oil costs 4 cents more than spraying trees of the same age with a 1-percent mixture. This is double the difference between the cost of spraying trees 1 to 4 years old and trees 8 years and older with a 1-percent mixture. The cost of fumigation is graduated according to the size of the grove and size of the trees. The large grove can be treated more cheaply because of the more effective use of equipment.

Table 30. - French Morocco: Cost of spraying with white oil (Volck)

Age of trees	Percentage of oil in spray	Cost per tree 1/	
	Percent	French francs	U.S. cents
1 to 4 years	1	28	8
	2	37	11
	2½	42	12
5 to 7 years	1	30	9
	2	43	12
	2½	50	14
8 years and older ...	1	34	10
	2	52	15
	2½	60	17

1/ Rate of conversion: 320 francs = $1.00. Price includes material and application including charges for equipment and labor.

Source: Pest control company in Casablanca.

Table 31. - French Morocco: Cost of fumigating orange orchards with hydrocyanic gas

Number and size of trees	Cost per tree 1/	
	French francs	U.S. cents
500 to 1,000 trees:		
Up to 1½ meters	80	23
Up to 2½ meters	95	27
Over 2½ meters	115	33
1,001 to 2,000 trees:		
Up to 1½ meters	75	21
Up to 2½ meters	90	26
Over 2½ meters	110	31
2,001 to 5,000 trees:		
Up to 1½ meters	70	20
Up to 2½ meters	85	24
Over 2½ meters	105	30
5,001 to 10,000 trees:		
Up to 1½ meters	65	19
Up to 2½ meters	85	24
Over 2½ meters	100	29

1/ Rate of conversion: 320 francs = $1.00.

Source: A pest control company in Casablanca.

Experiment Station

There are several leaders in the Moroccan citrus industry who have been educated in American universities and who are exceedingly interested in modern citrus cultural methods. Some experimentation has been carried on with citrus plantings, and one such experimental orchard was operated for a time at Marrakech.

The central office of the Moroccan Department of Agriculture near Rabat has a large selection of citrus varieties in the beautiful botanical gardens. These gardens also include other crops such as avocados and pecans.

Cultural problems, varieties, and pathology are all subjects of investigation. The experiment station has a capable staff which should be able to give excellent advice on the solution of Moroccan citrus cultural problems.

In addition to the work being done at the botanical gardens at Rabat, there is an agricultural school at Meknes. Also located at Meknes is a branch of the Moroccan Department of Agriculture, and a similar branch exists at Fes. The offices at Meknes and Fes represent the Department of Agriculture in the field and take care of local cultural problems.

Marketing

The recent increase in citrus production in Morocco coincided with increasing demands from France. Morocco has therefore had little difficulty in marketing its citrus. As supplies of citrus increase, however, Morocco fears that it may be faced with a marketing problem and is seeking to find another possible fruit outlet such as Western Germany or the United Kingdom.

According to a statement which appeared in a Moroccan citrus publication, the Moroccans recognize Spain as their most direct competitor but believe that Morocco holds a more sound position than Spain in view of the following advantages:

1. Earlier maturity of fruit by several weeks.

2. Quality of fruit.

3. A favorable geographic situation. Morocco can ship citrus to France by sea; Spain must ship 1,600 kilometers (995 miles) by rail, and the fruit has to be transferred from one rail car to another at the Spanish-French border.

4. Currency. Since the Moroccan franc is based on the French franc, there is no problem of exchange. Also, when Spanish fruit sells for 2 pesetas per kilo at the French border this is favorable to Morocco at an exchange rate of 16 francs to one peseta or 32.80 francs per kilo.

The control of the quality of all export fruit is handled by the Office Cherifien de Controle et d'Exportation, a Government organization which controls other crops, in addition to citrus. This organization employs inspectors who make a final inspection when the fruit is delivered to the quay for exportation. On their visits to packing plants, recommendations are made only as a means of educating the packers in the proper kind of fruit to export.

The export of citrus from Morocco is well organized and covered by regulations, excerpts of which are appended to this report. The operation of these export controls will no doubt assist Morocco in establishing itself in international markets.

Harvesting

Fruit is harvested by local laborers both men and women, who usually live on the property. Because of the large size of the trees it is necessary to use ladders when picking. The fruit is clip-picked into standard picking bags, and small field boxes holding approximately 55 pounds are used for transporting the fruit from orchard to packing house. The cost of harvesting the fruit and transporting it to the packing house on the grove property is approximately half a franc per kilo.

Packing

The citrus of Morocco is sold primarily to private buyers, who buy the fruit either on the tree or picked, in the grove. In Morocco there are approximately 180 to 200 such packers of fruits and vegetables. Forty of them are located in Casablanca. The fruit is hauled to a packing shed, usually located near a distributing center such as Casablanca. The fruit is usually washed, graded, sized, and packed unwrapped. The better grades are packed in 30-kilo, two-compartment, Florida-type, nailed boxes for export. These containers have ends made of light wood with a protecting framework, and packers prefer them to the solid-end box used in California. Some of the plants use a great deal of hand labor--sometimes even the boxes are made by hand.

Several of the packing houses at Casablanca were visited in 1949. On the whole, they were small operations; however, they did possess washing and grading machinery.

Efforts are being made to develop cooperative marketing, and one large cooperative packing house is in operation at Marrakech, and another at Sidi Slimane. These cooperative packing houses are modern operations compared to the packing houses of the usual small fruit buyer. In addition, some of the large growers have excellent small installations on their own property. Installations of this kind were visited at Marrakech and on large citrus properties on the Oued Ouergha. Fruit from the Oued Ouergha must be packed since it has to be hauled 60 to 75 miles by truck to port.

At Casablanca there is one large installation which is a combination processing plant and fresh fruit packing plant. This is not an unusual combination in North Africa. This property is unique, however, because of its size. It has an estimated capacity of approximately 350 tons of fruit per day for fresh and processing purposes. This plant is equipped with the most modern United States washing, waxing, and grading equipment.

The private fruit buyer in Morocco may soon meet very severe competition from growers. One well-informed source advised that 13 packing plants of United States manufacture had been installed at private Moroccan groves during 1948 and 1949. These on-the-farm plants will enable the grower to become an exporter as well as a producer.

An on-the-farm packing house is a distinct advantage if the grove is large enough to furnish a sufficient volume of fruit. The fruit arrives at the packing house in better condition because of a shorter transport. An even greater advantage is that it reduces the spread of citrus pests; field boxes do not leave the grove, and pests are not carried from one grove to another by this means.

Table 32. - French Morocco: Cost of packing oranges at Marrakech, 1949

Item	Cost per kilo	Cost per pound
	Francs	U.S. dollars
Picking	0.35	0.0005
Box, shipping, nailed	5.50	0.0078
Packing, labor (no wraps used)	4.00	0.0057
Overhead	2.00	0.0028
Transport to Casablanca	1.42	0.0020
Total	13.27	0.0188
Cost per 30-kilo (66 lb.) box	398.10	1.24

Source: Trade sources.

Transportation

The transportation facilities are generally quite excellent. Motor trucks are used for most of the transportation in and around the grove and for hauling the fruit from the local packing house to the port.

All of the citrus districts of Sidi Slimane, Meknes, Fes, Oudjda, and Marrakech are on the main line of the railroad. The citrus grown in the Oued Ouergha district is packed on the farm and transported from grove to railway by truck.

Fruit from groves which are situated in the interior probably could not be utilized in processing because of transportation cost. However, it would seem that considerable quantities of fruit could be sold at the local markets which are held weekly and attract great numbers of people from the surrounding country. Fruit from the northern district is exported through either Casablanca or Port Lyautey. The distance from Sidi Slimane, the largest district, to Port Lyautey is approximately 50 miles.

Freight Rates

Freight rates play a great part in the marketing of Morocco's citrus fruits, since the larger areas of production are at least 50 miles from the coast, the region of Marrakech being the farthest inland. Table 33 gives the approximate cost of transport from the citrus district to actual or potential Western European markets.

Table 33. - Cost of shipping citrus to French Atlantic Ports and to Liverpool

Item	Rate per metric ton 1/	Rate per box
Sidi Slimane to French Atlantic ports		
Rail freight: Sidi Slimane to Port Lyautey..	517 fr.	$0.05
Sea freight: Port Lyautey to French Atlantic ports....................	4,700 fr.	.47
Loading charges at Port Lyautey............	1,436 fr.	.14
Export tax.................................	325 fr.	.03
Total, on board ship at Fr. Atlantic ports	....	$0.69
Marrakech to French Atlantic ports		
Rail freight: Marrakech to Casablanca.......	1,418 fr.	$0.14
Sea freight: Casablanca to Fr. Atlantic ports	4,360 fr.	.43
Loading charges at Casablanca..............	1,436 fr.	.14
Export tax.................................	325 fr.	.03
Total, on board ship at Fr. Atlantic ports	....	$0.74
Marrakech to Liverpool		
Rail freight: Marrakech to Casablanca.......	1,418 fr.	$0.14
Sea freight: Casablanca to Liverpool 2/.....	125 s.	.56
Loading charges atCasablanca................	1,436 fr.	.14
Export tax.................................	325 fr.	.03
Total, unloaded at Liverpool...............	....	$0.87

1/ Foreign currency converted as follows: 320 Moroccan francs = $1.00.
1 English shilling = $0.14.
2/ Includes unloading charges.

Source: Compiled from official sources.

Domestic Consumption

The domestic consumption of citrus fruits in French Morocco is influenced greatly by the export situation. In recent years the export market has been sufficiently profitable to remove the major supplies of fruit from domestic markets. The domestic market of French Morocco is, therefore, a residual claimant on local citrus supplies.

Because of the limitation of supplies, retail prices of citrus fruits are usually quite high in French Moroccan coastal cities such as Rabat and Casablanca.

Table 34. - French Morocco: Average retail prices of early citrus fruit in the central market of Casablanca

Fruit	October				November			
	1948		1949		1948		1949	
	Francs per kilo	US $ per lb.	Francs per kilo	US $ per lb.	Francs per kilo	US $ per lb.	Francs per kilo	US $ per lb.
Navel oranges..	65	0.09	59	0.08	23	0.03	37	0.05
Other oranges..	57	0.08	50	0.07	1/	1/	40	0.06
Clementines....	70	0.10	69	0.10	31	0.04	38	0.05
Lemons.........	55	0.08	62	0.09	35	0.05	45	0.06

1/ Not available.

Source: Compiled from La Conjonature Economique Marocaine.

The extent of the domestic market will not be apparent until supplies are large enough to permit the distribution of fruit at lower prices than at present. From the yield of Moroccan citrus groves and the cost of operation, it would seem that citrus growers could make a profit at a price of 10 francs per kilo at the grove. Considering the transportation costs from the grove to market and the fact that fruit for local consumption would not require the use of packing cases and in all probability, would be shipped in bulk, it would seem that retail prices of from 12 to 15 francs per kilo would be possible. When prices reach this level, a great expansion in the domestic consumption of fresh citrus may be anticipated.

Exports

The rapid growth of citrus exports from French Morocco between 1935 and 1950 is illustrated in table 36. The exports to Algeria are not true exports since they represent shipments of fruit from the Moroccan citrus district in the vicinity of Oudjda through the Algerian port of Oran. The destination of such shipments is usually France, since Oran is connected with French ports by regular steamer service.

Oranges. Exports of oranges increased rapidly between 1935 and 1950. In 1935, French Morocco was still a minor citrus district and exported only 77,000 boxes. The 1949-50 export of over 3 million boxes set a new record and placed French Morocco in the position of a major supplier of oranges.

France was the only major importer of citrus from French Morocco until the 1949-50 season. In 1949-50, Western Germany increased its orange imports to such an extent that it became the second most important customer, and French Morocco broadened its market by exporting important quantities to the United Kingdom, the Netherlands, and other European countries. Exports to France were about 400,000 boxes less in 1949-50 than in 1948-49, in spite of the increased supplies available.

One of the factors which has made Germany an important customer is that Germany receives large supplies of oranges from Italy in bulk shipments and is accustomed to fruit that is unwashed and unwrapped. The unwrapped fruit exported from French Morocco is, therefore, more acceptable in Germany than it would be in European markets which are accustomed to the fully wrapped packages from Spain and South Africa.

In 1950, several English importing firms showed an interest in developing trade with French Morocco and established offices in Casablanca. Exports of oranges to England may increase in the next few years; however, they will probably not be large until French Morocco can successfully prepare a fully wrapped package for the English market. The present package of unwrapped fruit is not acceptable in the English market unless it is sold at a substantial discount. Because French Morocco obtains higher prices for its fruit in other markets, it does not yet regard the United Kingdom as an attractive market.

As the production of oranges continues to increase in French Morocco it is possible that exports of oranges may reach 6 million boxes per year by the season of 1960-61. The growth of exports will depend on many factors besides production. Morocco has many difficulties to overcome in developing an export package which can compete with exports from other citrus supplying areas on the European market.

Tangerines. The export of tangerines has also increased during the last 15 years but not so dramatically as that of oranges. The markets are approximately the same as for oranges: France is the outstanding customer, and Germany is second in importance. This relationship is likely to continue for some time. Tangerine exports are not likely to be much above the 1949-50 level, of 97,000 boxes per year in the next 10 years.

Clementines. Exports of clementines have increased more rapidly than exports of tangerines, and 322,000 boxes were exported in the 1949-50 season, compared with only 2,300 boxes in 1943. The clementine is an early fruit which is greatly appreciated in Europe. The harvest in Morocco begins about October 15, and in 1950 the first clementines reached the markets of Europe before the first of November. France is the chief importer, and the United Kingdom is the only other country which receives shipments of any real significance. In the next 10 years exports are unlikely to exceed the 1949-50 level of 322,000 boxes by any large percentage; they may reach a maximum of 400,000 boxes per year.

Lemons. Exports of lemons increased from only 507 boxes in the calendar year 1935 to nearly 38,000 boxes in the 1949-50 season. France is the most important customer, with Western Germany next, and this relationship is likely to continue in the future. Further increases in the export of lemons may be expected, but it is unlikely that they will exceed 50,000 boxes per year in any year prior to 1960.

Grapefruit. Exports of grapefruit increased from 449 boxes in 1943 to over 51,000 boxes in the season of 1949-50. France and Germany are the most important customers for this variety also, Future exports may be somewhat above present levels, but it is doubtful that they will exceed 75,000 boxes in any year before 1960.

Fruit exporters in the coastal towns such as Casablanca buy fruit from many sources, and a shipment of 1,000 boxes may include fruit from several districts raised under varying conditions. Some of the fruit may be in poor condition and encourage decay. A further standardization in the export shipment according to producing district may also be a necessary part of export market development. In order to expand the export market to its fullest extent Moroccan exporters may have to be satisfied with a somewhat lower price than has been received in recent years. As fruit becomes increasingly available for export, it is likely that the domestic market will be better supplied. If the local markets are supplied with fruit at reasonable prices they can absorb a significant percentage of French Morocco's citrus production.

Table 35. - French Morocco: Citrus exports, by month, 1948-49 season 1/

Month	France	French overseas territories	Other countries	Total
	Boxes	Boxes	Boxes	Boxes
1948:				
October				
November	209,406	2,866	24,597	236,869
December	834,032	10,582	35,494	880,108
1949:				
January				1/ 583,684
February	578,361	13,857	441	592,659
March	332,822	12,478	6,283	351,583
April	209,963	23,123	66	233,152
May	60,457	20,124		80,581
June	25,239	10,116		35,355
July	983	1,782		2,765
August		38		38

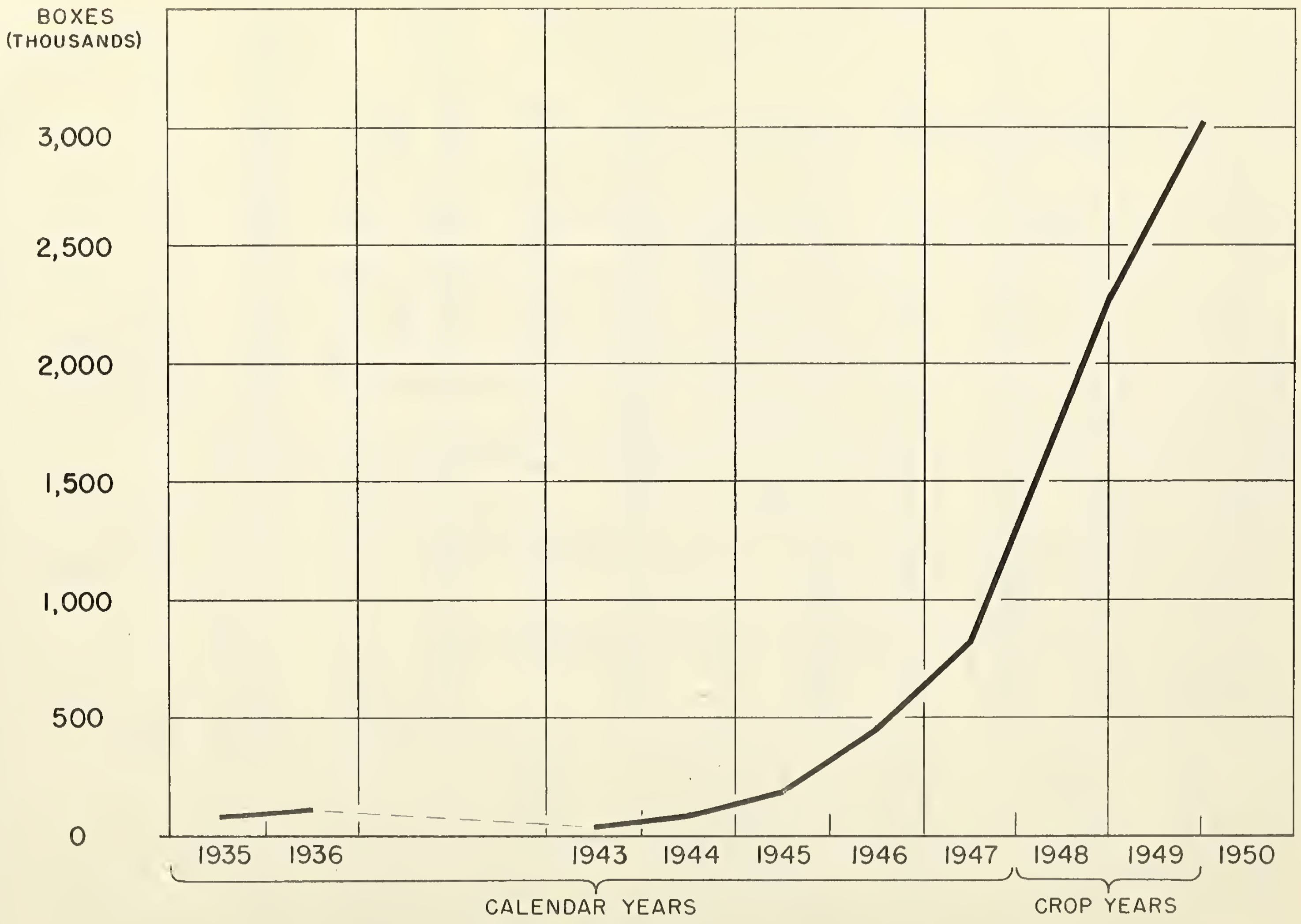
1/ A breakdown of monthly citrus exports by kind is not available. Exports have therefore been converted at the rate of 70 pounds to the box and do not agree exactly with figures in table 36. 2/Country breakdown not available. Source: Official sources and consulate reports.

Table 36.- French Morocco: Citrus exports by type, calendar years 1935, 1936, 1943-47, and crop years 1948-49 and 1949-50

Type and destination	Calendar year							Crop year	
	1935	1936	1943	1944	1945	1946	1947	1948-	1949-50
	Boxes	Boxes	Boxes	Boxes	Boxes	Boxes	Boxes	Boxes	Boxes
Oranges, sweet and sour:									
France	13,641	52,344	0	0	142,127	338,409	702,078	2,177,893	1,715,116
United Kingdom	112	1	210	0	0	0	22	756	41,132
Netherlands	4	0	0	0	0	0	0	0	34,234
Algeria	63,709	48,943	24,774	66,279	28,727	101,522	108,442	56,249	75,271
French West Africa	11	35	7,836	7,514		7,176	14,178	20,377	25,479
Germany	0	6	0	0	0	2,719	0	0	1,113,197
Switzerland	0	50	0	0	0	1,199	1,888	31	472
Others	21	18	0	5,781	409	527	2,690	6,173	19,527
Total	77,498	101,397	32,820	79,574	181,232	452,552	829,298	2,261,479	3,024,428
Tangerines:									
France	7,451	9,899	0	0	0	4,148	8,077	26,266	77,885
United Kingdom	4	0	0	0	0	13,209	3,289	1,795	2,551
Belgium	1	0	0	0	0	0	186	0	0
Algeria	7,238	9,329	1,208	679	622	484	225	189	3,559
French West Africa	9	10	256	98	121	0	298	1,827	3,622
Germany	0	0	0	0	0	0	0	0	9,637
Others	0	13	0	0	0	0	0	346	0
Total	14,703	19,251	1,464	777	743	17,841	12,075	30,423	97,254
Clementines:									
France			0	0	20,126	7,182	125,577	154,952	284,677
French West Africa			1,870	2,097	1,345	2,630	1,987	567	1,291
Algeria			484	1,183	7,086	7,423	1,074	1,165	976
Tunisia			0	0	0	0	0	0	0
United Kingdom			0	0	0	55,142	23,380	39,084	32,345
Switzerland			0	0	0	685	1,123	913	850
Belgium			0	0	0	0	879	598	283
Others			0	0	99	0	0	631	1,702
Total			2,354	3,280	28,656	73,062	154,020	197,910	322,124
Lemons:									
United Kingdom	29	309	0	0	0	0	0	1,160	899
Algeria	84	139	54	18	302	1,735	1,022	290	174
France	394	6,569	0	0	9,220	25,411	25,095	45,514	26,890
French West Africa	0	0	308	5	172	155	62	406	870
Germany	0	0	0	0	0	0	0	0	6,585
Netherlands	0	0	0	0	0	0	0	0	2,553
Others	0	0	0	0	0	0	0	0	0
Total	507	7,017	362	23	9,694	27,301	26,179	47,370	37,971
Grapefruit:									
France			83	0	10,183	18,008	24,382	27,916	38,829
French West Africa			366	60	50	0	0	28	0
Algeria			0	0	4	562	181	55	0
Switzerland			0	0	0	276	0	0	0
Belgium			0	0	0	0	139	0	0
Germany			0	0	0	0	0	0	10,858
Others			0	0	0	0	0	27	2,176
Total			449	60	10,237	18,846	24,702	28,026	51,863

Source: Official sources as reported in Consul Reports.

FRENCH MOROCCO: ORANGE EXPORTS



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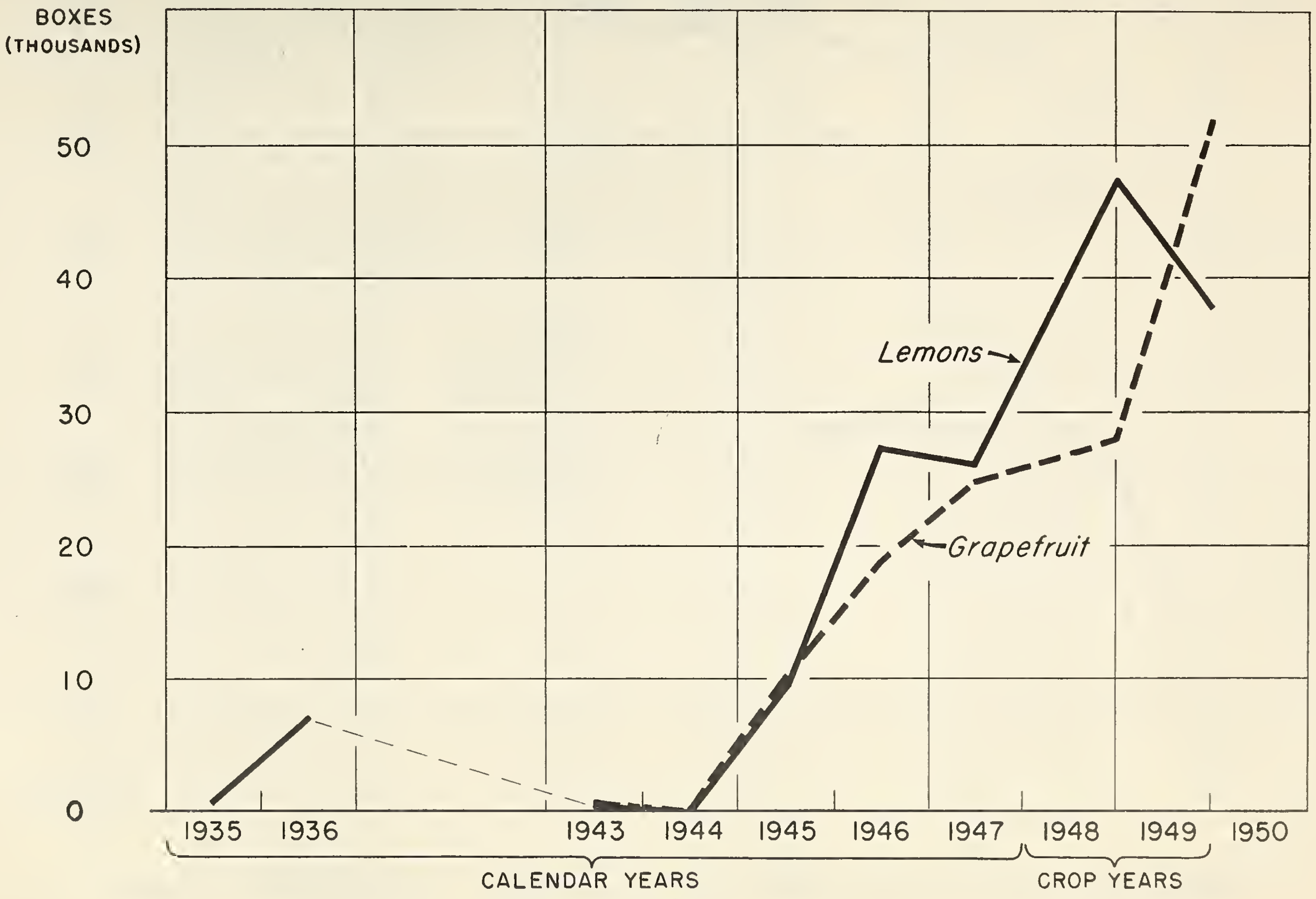
FRENCH MOROCCO: EXPORTS OF LEMONS AND GRAPEFRUIT



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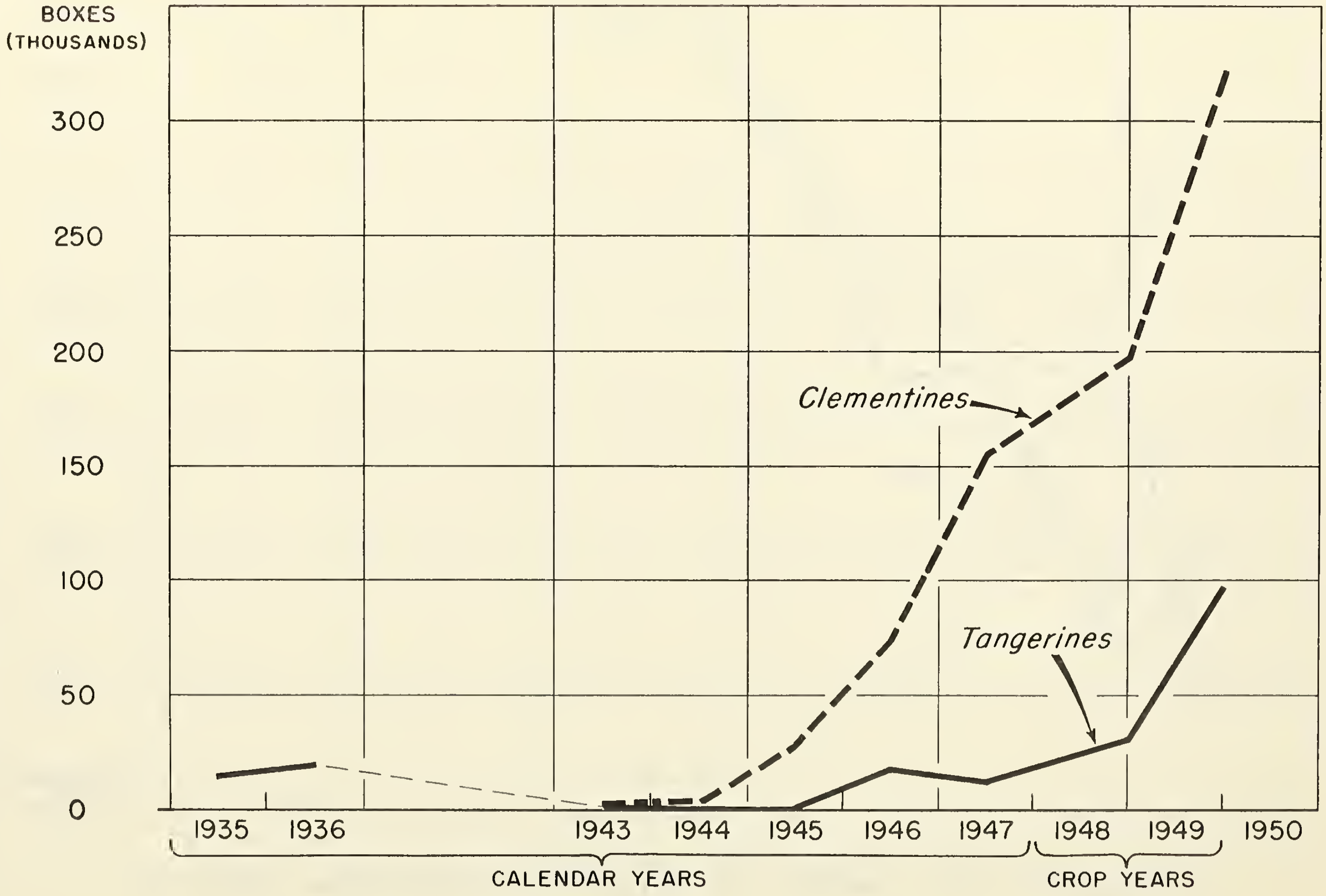
FRENCH MOROCCO: EXPORTS OF CLEMENTINES AND TANGERINES



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Economic Factors

This is a new citrus industry being developed from virgin land, and the major cost of present grove operation is that of building the young groves. As yet there are few mature orchards by which to judge the ultimate results of grove operation. Labor is inexpensive, abundant, but unreliable. Land is inexpensive, but the cost of machinery (e.g., tractors and pumping equipment) to level and develop it is high, as is the cost of fertilizer. All imported materials, such as box shooks which are obtained from France and portugal, are also expensive.

Price of Land

Industry representatives stated that undeveloped land without irrigation facilities sold in 1949 for 125,000 to 200,000 francs per hectare ($158.08 to $252.93 per acre). A 12-year-old grove sold for 1,800,000 francs per hectare ($2,276.41 per acre). Groves selling from 1,000,000 to 1,200,000 francs per hectare ($1,264.67 to $1,517.60 per acre) found willing buyers in 1949.

Taxes

As a protectorate and not a part of France, French Morocco operates under a different tax structure than does France. Taxes are based upon the number of productive trees, and the taxes are collected locally by an official who receives a percentage of the tax as his income. For this reason, statistics on number of trees, and acreage, may be considered to be accurate in Morocco.

The fact that Morocco is not a part of France has favored the investment of French and other foreign capital here. This has been a big factor in hastening Morocco's rapid development.

Cost of Production

Yield of Moroccan Citrus Groves

It is difficult to compute the cost of production since most Moroccan groves are young, and the levels of fruit yield have not been established. For example, one large grove with 300 hectares (741 acres) under cultivation had 200 hectares (494 acres) planted to apricots and citrus, but only 30 hectares of the 200 were full-producing citrus. The yield was not kept separately by grove blocks, and with all costs and yields lumped together for both young and old trees, the cost for the 1948-49 season was 19.29 francs per kilo ($0.03 per pound).

Growers estimated from the production of full-bearing trees that the following may be considered as the average to be expected in Morocco when trees reach full bearing at 15 to 20 years of age:

	Production per tree	Production per hectare (178 trees)	Production per acre (72 trees)
	Kilos	Kilos	Boxes
Navel oranges	100	17,800	226.9
Valencia Late	123-140	22,000-25,000	280.4-318.6
At Marrakech, best production ...	200	35,600	453.7
At Sidi Slimane best production ...	255	45,390	578.5

The many full-bearing trees seen in widely dispersed sections of Morocco confirm these estimates of the expected levels of production. Many large 20-year-old orange trees were growing with exceptional vigor and carrying a crop that would average 15 boxes to the tree.

The yield record of a young grove in north Morocco located on a watercourse, planted in deep alluvial soil--a sandy loam--is illustrative of conditions in that area (see table 37). The trees were planted 8 meters (26 feet) apart. Water was pumped from the nearby river which in August 1949 had a salt (NaCl) concentration of 918 mg. per liter. In 1946, the concentration of salt was 500 mg. per liter in October before the first rains. This grove was vigorous and quite representative of a watercourse culture.

Another large planting in northern Morocco which contained many young trees produced an average of only 30 boxes to the acre in 1945-46, but by the season of 1948-49 production had increased to 78 boxes an acre. This production is still too low to be considered commercial; however, since a great deal of this property is planted to young trees not yet in bearing, production is expected to increase rapidly in subsequent years. As is characteristic of most Moroccan orange groves, none of the trees are in full production.

The yield per acre for oranges in Morocco depends on the location of the grove and the care which is given the property. In the better citrus areas of northern Morocco growers estimate the yields from Washington Navel trees at 150 to 200 kilograms (331 to 441 pounds) per tree for orchards 10 years of age. High yields such as this should be considered as characteristic of the better maintained orchards in the valley plantings near Sidi Slimane. A great difference in production is characteristic of the watercourse orchards planted near rivers in quite mountainous country still farther north. For example, one grove with trees of the Valencia variety only 7 years of age, produced 40 kilograms (88 pounds) per tree in 1948. This is low production, but average considering the age of the trees. Production in orchards planted to the clementine variety is extremely erratic. In a northern Moroccan grove some trees produced 130 kilograms (287 pounds) per tree in 1948, but many trees in the same orchard had very little if any fruit. In this same region one orchard planted to clementines produced only 17 kilograms (37 pounds) per tree on the average.

Table 37. - Yield of a northern Moroccan orange grove, 1944-45 to 1948-49

Season	Age of grove in 1949									
	11		9-11		10		10		7	
	Clementine		Washington Navel		Portuguese (semi-blood)		Cadenera		Valencia or Verna	
	Kilos per hectare	Boxes per acre	Kilos per hectare	Boxes per acre	Kilos per hectare	Boxes per acre	Kilos per hectare	Boxes per acre	Kilos per hectare	Boxes per acre
1944-45	58	0.75	2,315	29.52	....	......	3,665	46.73	....	......
1945-46	1,590	20.27	3,671	46.80	2,781	35.45	4,192	53.44	742	9.47
1946-47	250	3.19	4,081	52.02	1,966	25.07	4,352	55.45	425	5.42
1947-48	4,070	51.87	8,656	110.34	4,550	58.01	8,928	114.26	386	4.93
1948-49	2,100	26.77	10,126	129.07	5,314	67.75	10,403	132.60	2,537	32.34

Source: Information supplied by a Moroccan grower.

Nitrogen fertilizer has never been applied to the majority of groves, particularly in northern Morocco. This has not been necessary in most cases since the groves are planted on virgin soil; but as trees come into production the need for the addition of nitrogen fertilizers will probably become apparent.

Two factors will, therefore, influence production in the future; first, the coming into bearing of the vigorously growing young orchards; and, second, the effect which nitrogen fertilizers will have on production when it becomes necessary to apply this material in a few years.

Cost of Operating Moroccan Citrus Groves

Morocco is such a new citrus area that little information is available regarding the cost of operation; however, mechanical tillage and native labor make the costs of operation relatively low. The cost of grove operation is influenced by the size of the planting, as mechnical tillage can be employed more effectively on a large grove. The age of the grove also affects the cost of operation.

In the absence of published cost data, the information obtained in interviews with growers regarding the costs in several areas is presented here. It is hoped that this will be helpful in indicating the approximate costs of operations.

Marrakech. In 1949 the cost of operation of a young navel orange grove not yet producing was approximately 40,000 francs per hectare ($50.59 per acre) per year. The annual cost of operating a producing grove 15 years of age will range from 80,000 to 100,000 francs per hectare ($110.12 to $125.47 per acre).

From groves now in production it is evident that 15-year-old navels on the average may be expected to produce approximately 18 metric tons per hectare (229 boxes per acre) in a normal year and that production will range from 16 to 20 metric tons per hectare (204 boxes to 255 boxes per acre). Valencia Lates produce somewhat more heavily, and 22 to 25 metric tons (280 to 319 boxes per acre) may be realized. At a production of 18 metric tons per hectare (229 boxes per acre) and at a price of 30 france per kilo ($0.04 per pound) on the tree a gross income of 540,000 france per hectare ($682.92 per acre) is realized. After deducting the operational cost of 100,000 france per hectare ($126.47 per acre), this leaves a profit of 440,000 francs per hectare ($556.45 per acre). In a grove which produces 18 metric tons of fruit per hectare (229 boxes per acre), a price of 5 francs per kilo ($0.007 per pound) on the tree will meet an operational cost of 90,000 francs per hectare ($113.82 per acre).

Northern Morocco. The actual cost of operating one grove in northern Morocco in 1947-48 was as follows:

	Francs per hectare	Dollars per acre
Overhead, travel, taxes, etc.	17,108	21.63
Cultural costs, including spraying, fertilization, irrigation, pruning, cropping, cultivation, windbreaks, and tree replacement	7,596	9.61
Total cost	24,704	31.24

Income from a smaller grove in 1947-48 was as follows:

	Francs per hectare	Dollars per acre
Gross income	472,483	597.54
Less total expenses	42,000	53.12
Profit	430,483	544.42

The cost of operating a larger grove with younger trees in 1947-48 was as follows:

	Francs per hectare	Dollars per acre
General expenses	5,398	6.83
Cultural expenses	12,284	15.53
Total cost	17,682	22.36

The costs of approximately 24,000 and 17,000 francs per hectare listed above are lower than average and may be considered examples of the most efficient operation. It is estimated that the cost of production in Morocco generally averaged between 50,000 and 75,000 francs per hectare ($63.23 to $94.85 per acre).

The costs of a northern Moroccan orange grove listed in table 38 may be considered as typical of the factors involved in the development of groves planted along watercourses. This grove was started in 1938 with the clearing of brush.

Water for irrigation is obtained from the river nearby. In 1949, four irrigations were made between July 15 and December. Since the fall season was dry, it was planned to apply two more irrigations after December unless rainfall should make further irrigation unnecessary. The northern Moroccan watercourse citrus areas usually have very heavy winter rainfall in normal years. While the 1949 fall had been extremely dry, retarding the maturity of the fruit by at least 3 weeks as compared with normal years, there was a very heavy rainfall on the 19th of November. At that time it rained 123 mm. (4.7 inches) in 24 hours.

Table 38. - Cost of operating a northern Moroccan orange grove in 1948

Item	Native labor		European admin.		Insurance, taxes, etc.		Vehicle, tractor, and pump upkeep		Material		Total	
	Francs per hectare	Dollars per acre	Francs per hectare	Dollars per acre	Francs per hectare	Dollars per acre	Francs per hectare	Dollars per acre	Francs per hectare	Dollars per acre	Francs per hectare	Dollars per acre
General expenses...	4,977	6.30	12,000	15.18	3,600	4.55	5,000	6.32	......	.....	25,577	32.35
Cultivation..	6,360	8.05	......	.....	......	.....	13,000	16.44	6,020	7.61	25,380	32.10
Irrigation...	3,390	4.28	......	.....	......	.....	4,450	5.63	3,000	3.80	10,840	13.71
Fertilizer...	720	.91	......	.....	......	.....	......	.....	3,600	4.55	4,320	5.46
Pest control.	880	1.11	......	.....	......	.....	......	.....	3,800	4.81	4,680	5.92
Pruning......	1,300	1.64	......	.....	......	.....	......	.....	100	.13	1,400	1.77
Harvesting...	2,592	3.28	......	.....	......	.....	......	.....	3,300	4.17	5,892	7.45
Total	20,219	25.57	12,000	15.18	3,600	4.55	22,450	28.39	19,820	25.07	78,089	98.76

Source: Actual cost data supplied by a northern Moroccan citrus grower.

The grower stated that in his opinion this grove was not cultivated according to the very best practices and that fertilizer should probably be applied more abundantly. During 1948 only the Valencia and the verna varieties received manure, the application being about 40 cubic meters per hectare, (572 cubic feet per acre). The rest of the orchard received about 2½ kilograms, (5½ pounds) of "phosphate of lime." No nitrogen fertilizer was applied to this orchard. The heavy winter cover crop in the orchards constitutes a source of green fertilizer; nevertheless, the grower expects that in the future it will be necessary to apply some nitrogenous mineral fertilizers since the trees are now coming into bearing.

This grove is surrounded primarily by virgin land, and there is little possibility of infestation from other citrus orchards in the vicinity. In addition to treating the shady side of the tree with oil spray, two applications of 5-percent DDT were made in 1949--in September and October--to reduce the damage of the Mediterrnean fruit fly.

Accounting practices. In French currency areas as in other European countries where there has been a serious devaluation of the currency the problem of amortization is very interesting. Since values to be amortized are often established under a completely different currency situation, realistic accounting practice makes necessary the adjustment of the invested values in a manner comparable with the extent of the devaluation. For example, in the grove under consideration the grower at present is amortizing at the rate of 24,000 francs per hectare ($30.35 per acre) per year, although in considering the values of the fixed investments at the present deflated value of the franc he estimates that the annual rate of amortization of this investment should be 80,000 francs per hectare ($101.17 per acre). The accounting practices of citrus growers in North Africa are generally quite different from those in common use in the United States. This grove in North Morocco is being amortized yet could not be considered in full bearing; and in accordance with United States accounting practice the amortization of this grove would not be properly applied for some years to come. Another accounting practice is to include items of capital expenditure in the yearly cash cost of operation. An example of this would be the installation of a concrete pipe for irrigation. This is certainly a fixed expenditure which should be charged to the capital account. However, some growers charge such expenses to current operation, and thus greatly increase the cost of operating the grove for that year.

Summary of Cost of Production [4]

Considering the above cost and yield factors the estimated cash cost of orange production in Morocco may be summarized as follows:

	High	Low
Cost of operation:		
Francs per hectare	75,000	50,000
Dollars per acre	94.85	63.23
Average yield:		
Kilos per hectare	20,000	20,000
Boxes per acre	254.9	254.9
Cost of production:		
Francs per kilo	3.75	2.50
Francs per 30-kilo (66-pound) box	112.50	75.00
Dollars per 66-pound box	0.35	0.23

Break-even Cash Costs f.o.b. Moroccan Ports

Considering the above cost and yield factors, the 1949 break-even cash costs for groves in full production may be computed as follows:

	High	Low
Cost of production:		
Francs per kilo	3.75	2.50
Dollars per box	0.35	0.23
Cost of picking and packing:		
Francs per kilo	11.85	10.00
Dollars per box	1.11	0.93
Transport to port:		
Francs per kilo	1.42	1.42
Dollars per box	0.14	0.14
Total:		
Francs per kilo	17.02	13.92
Francs per 30-kilo (66-pound) box	510.60	417.60
Dollars per 66-pound box	1.60	1.30

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[4] These are cash costs and do not include amortization.

Morocco has the lowest on-the-tree break-even cash costs of production of any area in North Africa. However, all major citrus-producing areas in Morocco are 60 to 160 miles from a seaport from which shipments can be made to European markets. The extra cost of transport involved offsets the lower on-the-tree cost of production.

The costs of packing as stated are generous. It is evident that the problems of the Morocco citrus grower concern packing and transport rather than production. Packing costs, however, are incurred only on fruit which is exported. Fruit sold locally is not packed, and it can, therefore, be brought to coastal markets such as Casablanca for a break-even cost of not more than 8 or 9 francs per kilo ($0.01 per pound), including the cost of a suitable container for transport to the local market.

Processing

The processing plants in Morocco are located on the coast, rather than in the citrus districts, since most of them are primarily engaged in canning tomatoes or other vegetables, and fish and meat products. Because of this, all citrus must be shipped a considerable distance by rail or truck to the plants.

Since Morocco is an early citrus district, it specializes in early varieties such as the navel, which is not the best orange for juicing.

Because of the two factors of transportation cost and fruit varieties Morocco will probably not be a major processor of citrus products in spite of the excellent processing equipment now installed.

Processing Plants

Casablanca. Excellent citrus processing plants exist in Casablanca. One organization is operating a new plant constructed by an American organization. This plant has modern fruit storage bins outside the plant, and it contains high-quality juicing and canning machinery which is primarily of American manufacture. All canning machinery is automatic, except that the juicing is done manually on revolving spindles, using a Hewitt extractor manufactured in Buffalo. This plant has a capacity of 1,200 liters (317 gallons) of juice per hour. It is in a modern building of excellent design, and it has showers which the employees are required to use before going to work. All machinery gave evidence of high standards of maintenance.

In the middle of February 1949, a very large citrus processing plant went into operation at Casablanca. This plant is located on a 10-acre site and has three buildings, all of which are either stone or concrete. This plant is well-equipped, and much of the machinery is of American manufacture. It has the capacity to handle 350 metric tons

(386 short tons) of fresh fruit a day. Two hundred fifty tons (276 short tons) of this can be handled as a fresh pack and capacity for the processing of the balance is available. The fresh fruit machinery includes the latest washers, dryers, waxers, grading table, and three sizers of large capacity. At the time the plant was visited, only a stainless steel, hand extractor was being used, but two automatic juicers had been installed and six more were being planned, officials said. The plant also contains newly installed apparatus for the manufacture of 65° Brix concentrate. The fresh fruit, empty cans, and finished product are handled by power conveyors. When in full operation, the plant will employ 400 people, 25 percent of whom will be Europeans. Machinery is available for the manufacture of essential oils from citrus rind, and cattle feed from the peel and pulp. It is also planned to manufacture citrus bases for bottling and marmalade. The plant will manufacture and bottle an orange drink for local consumption, and has machinery for this purpose, including automatic bottling facilities.

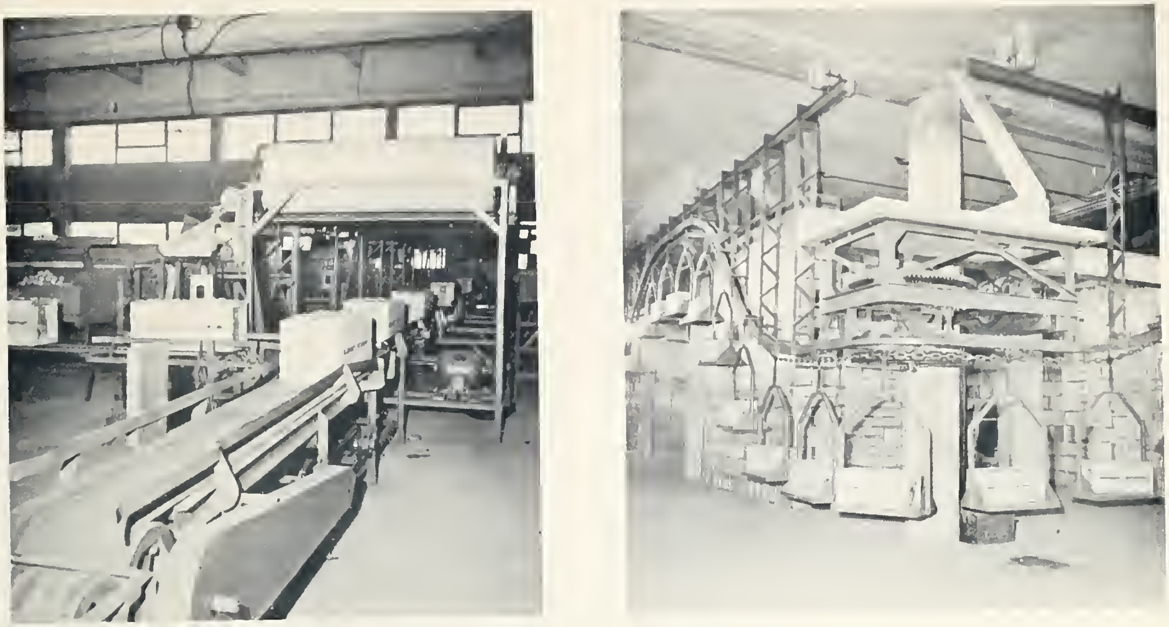
Both of these plants in Casablanca will process tomato products in addition to citrus, making canned tomato juice, catsup, tomato paste, and puree. The large plant mentioned above is a major processing unit which would cost at least 2 million dollars to duplicate in the United States.

A third processing plant produces single-strength juice which is widely distributed in the French market. The plant is primarily for the processing of tomatoes, and most of the equipment is designed to be used interchangeably for citrus and tomatoes. The plant is small but flexible and has excellent equipment. The juice is extracted by hand, is flash-pasteurized, and is canned automatically. The plant has a producing capacity of 1,000 liters (approximately 270 gallons) of canned single-strength juice per hour. This plant uses a very small 4-ounce can for a portion of the pack.

Fedala. A multipurpose plant at Fedala cans vegetables, fish, meat products, and citrus in season. The citrus capacity is rather small; about 10 tons of fruit can be processed into 300 or 400 liters (79 to 106 gallons) of single-strength juice per day.

At the time this plant was visited in the fall of 1949 the citrus-processing machinery was dismantled, and vegetables and fish products were being processed citrus is of small importance compared with the main processed products such as tomatoes and fish and meat.

Port Lyautey. The small packing plant at Port Lyautey is located nearest to major citrus-producing areas. This plant was not visited, but its products were seen on exhibit at the fair at Casablanca and for sale at Fes. Like other plants in French Morocco, the major capacity of the plant is devoted to products other than citrus.



Views of citrus being packed in a modern packing house at Casablanca.

A new, multipurpose plant at Casablanca where citrus fruit is packed fresh and processed. Other fruit and vegetables are also processed.

Table 39. - Analysis of canned citrus juice from Morocco

Analysis category	Unit	Orange	Lemon
Date of analysis		December 8, 1949	December 9, 1949
Size of can	Inches	3-7/16 x 4-5/16	2-15/16 x 4-8/16
Fluid measure	Fluid ounces	19	12.8
Vacuum	Inches	3 (dented seam)	3 (badly dented)
Density	Degrees Brix	13.5°	12.3°
Anhydrous citric acid per 100 ml.	Grams	1.8	6.9
Pulp	Percent	12	2
Recoverable oil by volume		None	Negligible
Ascorbic acid per 100 ml.	Milligrams	65.42	60.11
Color		Excellent	Fair, slight brown cast
Absence of defects		Practically free	Practically free
Flavor		Sharp, acrid, poor	Sharp, slight terpine flavor and odor
Ratio of soluble solids to citric acid		7.5:1	
U. S. grade		D or Substandard	C or Standard
Comment		Grade account of flavor, excess acid and ratio of soluble solids to acid	Grade account of flavor

Source: Tested by Standardization and Inspection Division, Fruit and Vegetable Branch, Production and Marketing Administration of the United States Department of Agriculture.

Testing Moroccan Citrus Juices

Some samples of citrus juices were obtained during visits to processing plants; others were purchased in retail markets. Table 39 shows the results of the analysis of an orange and lemon juice which may be considered representative of the canned citrus juices produced in French Morocco in 1949.

Moroccan Processed Citrus Products

The most important processed citrus product in French Morocco is single-strength juice. This may be flash-pasteurized, deaerated, and canned, or preserved with sulfurdioxide and packed in paraffin-lined barrels for the English squash industry. Some pulp is manufactured, and jams and beverage bases are prepared for the local bottling industry. At least one plant is planning to make small quantities of marmalade; however, the amount of this product will probably be limited, since it is customary in Europe to utilize the bitter orange for marmalade and the production of bitter orange is very small in Morocco.

As observed, only one processing plant, a large new installations, has facilities available for the concentration of citrus juices. However, there has been some investigation of the possibility of producing orange juice concentrate for sale to the United Kingdom for use in the Child Health Program.

Some Moroccan processors furnish peels in barrels to the French manufacturers of liqueurs such as Cointreau. This is said to be a profitable market for the peel residue.

Processing Cost

The most important cost to Morocco citrus processors is the capital cost of the plant and machinery. Capital costs are reduced, however, by utilizing the same building and much of the same equipment for the processing of products other than citrus; if it were not for this fact the modern plants in Morocco would not be possible. The other important cost is the tin containers, which are supplied by the French tin-plate monopoly. According to one processor, the containers represent 40 percent of the cost of the finished product.

The following are some cost factors reported by roccessors in 1949:

Item	Unit	Francs	Dollars
Oranges, at the plant	kilo	13.00	-
Oranges, at the plant	ton	-	36.86
Extracting labor (women)	hour	24.00	0.08
No. 2 can (no lid)	each	17.00	0.05
No. 2 can (lid only)	each	5.00	0.02
No. 10 can (no lid)	each	45.00	0.14

Marketing

Canned single-strength juices were observed for sale in the larger cities in Morocco and France. Single-strength juices packed in casks are exported to France and other Western European countries, particularly for the squash industry in the United Kingdom. There is an additional outlet for orange-peel products in the French liquor industry, which absorbs considerable quantities of the product each year. In Morocco, itself, there is also an excellent market for dried peel products for cattle feed.

In 1949, the wholesale price for single-strength juice f.o.b., Casablanca was 1,650 francs ($5.16) per case of 24 No. 2 tins.

The five major processing plants in French Morocco were the largest and best-equipped plants seen in North Africa. Considering the varieties of fruit which French Morocco produces and the seasons, it would seem that the present plant capacity is in excess of the likely supplies of fruit and probably also in excess of the quantity of products which can be sold.

Since Morocco produces primarily early varieties of oranges such as navels, it is unlikely that large quantities of juice products will be produced. For this reason, although some concentrating equipment is installed, it does not seem likely that any large quantities of orange juice concentrate will be manufactured.

The high cost of tins will also be a handicap in meeting competition in international markets.

Conclusions

The citrus acreage in French Morocco has increased rapidly in the last 10 years and is continuing to increase at a rapid rate. The rate of increase in citrus acreage in Morocco is greater than that of any other North African district. Observations in citrus-producing areas indicate that fruit production will increase as new acreage comes into production. Considering the fact that the citrus acreage has approximately doubled since 1943, orange production may increase to 10 million boxes by the crop year of 1960-61. This forecast, of course, assumes that there will be no climatic disaster to destroy groves or fruit. As in other Mediterranean areas, the dominant root stock is sour orange root, and quick decline would be devastating.

Because of the short season and the varieties of oranges produced, it is unlikely that the processing industry may be profitably extended beyond present capacity. The present processing capacity of French Morocco may be in excess of the need or the existing market for its products.

French Morocco has the lowest on-the-tree production costs. However, since the major citrus areas are located 50 to 150 miles inland, transport costs reduce this advantage, making the break-even costs f.o.b. Moroccan ports approximately equal to the costs from Algeria. The cost of shipping box shook inland to the packing houses increases the costs of packing.

As larger supplies of Moroccan citrus become available, it will be necessary to develop markets outside of metropolitan France and Germany. Present shipments of oranges to France consist of unwrapped fruit packed in two-compartment boxes. It will be necessary to change the methods of packing to supply other European markets which demand full wrapped packs. Because of its early season and its outlet to Atlantic ports, it may be expected that French Morocco will become a major supplier of oranges to the United Kingdom within the next 5 years.

Another important factor in the marketing of French Moroccan oranges will be the increase in domestic consumption which will occur when it is possible to sell fruit in Moroccan seacoast towns such as Casablanca for a retail price of approximately 15 francs per kilo. This price is entirely possible considering the low on-the-tree production costs and the fact that the fruit would not have to be packed in boxes.

Because of their unsatisfactory production record clementines are being top-worked to orange varieties, and this will result in the extension of orange acreage in the next few years.

The conditions for the production of citrus in Morocco are exceedingly favorable. This, combined with modern cultural methods and the use of native labor, makes the costs of production very competitive. In addition, a great number of the orchards are being planted on virgin land which can produce abundant crops for some years with little or no fertilization. The citrus industry of French Morocco is in the most favorable position of any citrus district in North Africa. The production of citrus, primarily oranges, in French Morocco may be expected to continue to increase for a number of years and it is not unlikely that the production of citrus by 1960 may be at least 11 million boxes a year and that, at that time, the orange production of French Morocco will exceed that of Algeria.

III. THE CITRUS INDUSTRY OF TUNISIA

The citrus industry of Tunisia is of far less importance than that of Algeria or Morocco. It is also of an entirely different character, the holdings being much smaller on the average and the cultural methods far more primitive.

The native peoples in the vicinity of Tunis are of a different tribe from those of the other North African citrus areas, Berbers being the predominant group.

Tunis is close to Sicily, and the Italian influence is felt to a marked degree.

The citrus areas in Tunisia seem closer to the desert than in Algeria or Morocco, since there are no high mountain ranges separating the coastal region from the desert.

Topography, Climate, and Soils

Topography

Tunis is located on a low, flat plain, and most of the agricultural area is less than 200 feet above sea level. There are a few hills and unconnected mountain peaks in the vicinity of Tunis, but Tunisia has no continuous mountain ranges such as the Atlas Mountains which lie east of the coastal plain in Morocco or the mountain ranges which separate the desert area from the coastal agricultural area in Algeria.

Climate

Tunisia is more arid than Algeria, and the average rainfall in the citrus areas is 8 to 10 inches a year. The usual season of heaviest rainfall is from September to March; there is very little rainfall in the spring and none in midsummer. In extremely dry years the pumping of water for irrigation seriously reduces the supply of underground water, which is said to lie in layers separated by strata of impervious clay. Water in the upper strata may be entirely exhausted in times of drought, it is reported.

Because of the arid climate the monthly and daily range of temperature is wide. Citrus areas occasionally suffer damage from cold, and growers state that in 1941 the cold was sufficiently severe to defoliate the trees and to cause major wood damage. The effect of this cold weather on production is evident in the accompanying statistics. In the first week of February 1949 cold weather was experienced in Tunisia with light snowfall in Tunis; however, the only frost damage in citrus areas was to the tenderest button lemons.

Table 40. - Tunisia: Monthly minimum and maximum temperatures at Grombalia, 1946

Month	Minimum °F.	Maximum °F.
January	33.8	62.6
February	33.8	71.0
March	37.4	78.0
April	43.0	77.0
May	46.6	82.0
June	56.0	89.0
July	59.0	95.0
August	60.0	105.8
September	60.0	102.2
October	56.0	86.0
November	42.8	76.0
December	37.4	64.0

Soils

Unlike the heavy citrus soils of Algeria, those in Tunisia are very light. Some citrus plantings are made on almost pure sand which is so light that even rubber-tired wheel tractors cannot be used. Measures to protect the soil from wind must be taken even in winter, and this is sometimes accomplished by planting rows of lupine between the trees where the tree rows are 25 feet apart. The soil drainage is excellent, and one may walk through the orchards immediately following heavy rains. Picking of fruit would never be interrupted in Tunisia by rainfall.

Wind storms are frequent in Tunisia. In addition to the desert sirocco winds, storms often sweep across Cape Bon through the citrus areas. In some citrus orchards grass must be planted between the rows to keep the light sandy soil from drifting. Severe wind storms may create sand drifts 4 feet deep in citrus groves. Winds of hurricane force have uprooted trees in windbreaks and occasionally the citrus trees as well. The native orchards are closely planted, which reduces wind damage to a degree. This practice of close planting may be the result of long experience with damaging winds. Windburned fruit was seen on the trees in the summer of 1949.

Acreage

In 1943, approximately two-thirds of the citrus plantings in Tunisia were held by Tunisians, and only one-third by Europeans. In the Tunisian-owned groves about two-thirds of the trees were of bearing age, but in the European-owned groves at that time less than half the trees were of bearing age.

At the time of the census of 1943 (see table 41) less than half of the orange acreage and only one-third of the tangerine acreage were not of bearing age. The clementine variety had apparently only recently been introduced to Tunisia, and the majority of the acreage was not of bearing age. In lemons, less than half of the existing acreage at that time was not yet in bearing, and the acreage of lemons is increasing in the coastal districts of Tunisia.

The citrus plantings operated by Tunisians are not likely to produce fruit of quality and variety that will be suitable to European markets. Since these plantings are the dominant factor in the Tunisian citrus industry, it is unlikely that Tunisia will be of any great importance in international trade in the foreseeable future.

Table 41. - Tunisia: Census of citrus plantings, 1943

Kind of citrus	Area					
	Bearing		Young		Total	
	Hectares	Acres	Hectares	Acres	Hectares	Acres
Oranges........	1,425	3,521	962	2,377	2,387	5,898
Tangerines.....	296	731	133	329	429	1,060
Clementines....	37	92	92	227	129	319
Lemons.........	273	674	209	517	482	1,191
Bitter oranges.	123	304	---	---	123	304
Other citrus...	67	166	30	74	97	240
Total.......	2,221	5,488	1,426	3,524	3,647	9,012

Source: H. Rebour, Les Agrumes en Afrique du Nord, **Algeria,** 1945.

Production

The production of lemons and oranges in Tunisia from 1920-21 to 1950-51 is shown in table 42 and illustrated in the accompanying chart. From 1920 to 1935 orange production exceeded 100,000 boxes only in 1931-32. During this period, lemon production decreased and was even less important than orange production, being below 40,000 boxes per year for the entire period.

From 1935 to 1940 production of citrus increased rapidly; in 1940-41, about 677,000 boxes of oranges and 197,000 boxes of lemons were produced.

Although production was retarded during the war years, it was still above prewar levels. Production began to increase again in 1946, and the 1950-51 crop of over 1 million boxes of oranges and over 200,000 boxes of lemons was the largest on record.

As new acreage comes into bearing, higher levels of production may be expected. It is possible that in the next 10 years orange production may reach 1.5 million boxes and lemon production 300,000 boxes. These level are probably about the maximum which the region can support.

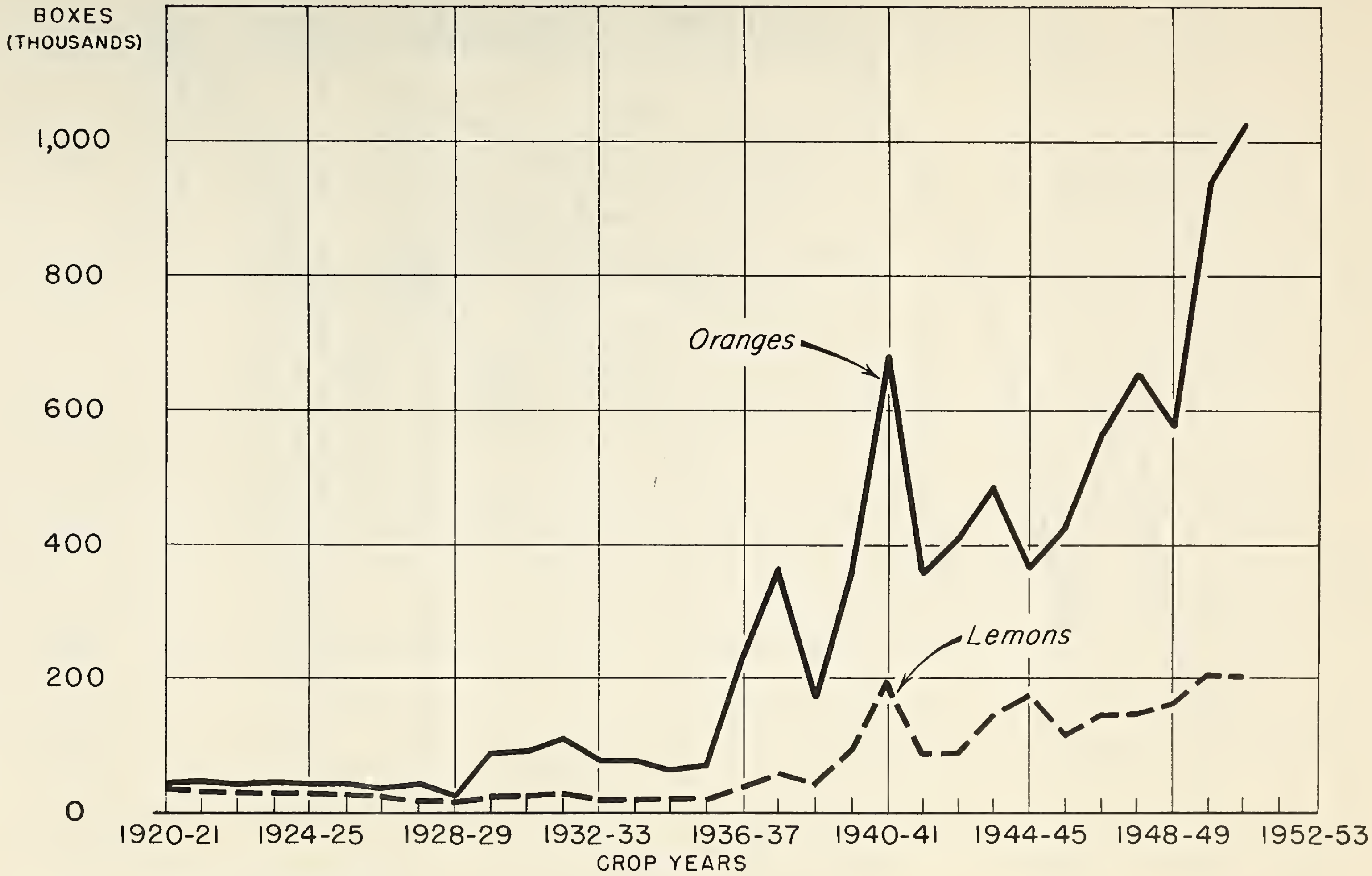
Table 42. - Tunisia: Production of oranges and lemons, 1920-21 to 1950-51

Season	Oranges 1/	Lemons
	Boxes	Boxes
1920-21	44,092	37,710
1921-22	47,871	31,909
1922-23	43,462	30,458
1923-24	45,352	29,008
1924-25	44,092	29,008
1925-26	44,722	26,107
1926-27	36,218	24,657
1927-28	34,644	17,405
1928-29	22,046	17,405
1929-30	88,184	23,206
1930-31	94,483	23,206
1931-32	110,230	26,107
1932-33	78,736	17,405
1933-34	78,736	17,405
1934-35	62,989	17,405
1935-36	69,287	17,405
1936-37	236,207	40,611
1937-38	362,184	58,016
1938-39	170,069	43,512
1939-40	355,885	92,826
1940-41	677,127	197,254
1941-42	359,035	87,024
1942-43	409,426	87,024
1943-44	488,161	145,040
1944-45	362,184	174,048
1945-46	425,173	116,032
1946-47	566,897	145,040
1947-48	651,931	145,040
1948-49	573,000	160,000
1949-50	939,000	203,000
1950-51	1,024,000	203,000

1/ Includes tangerines.

Source: Official sources.

TUNISIA: PRODUCTION OF ORANGES* AND LEMONS
1920-21—1950-51



*INCLUDES TANGERINES

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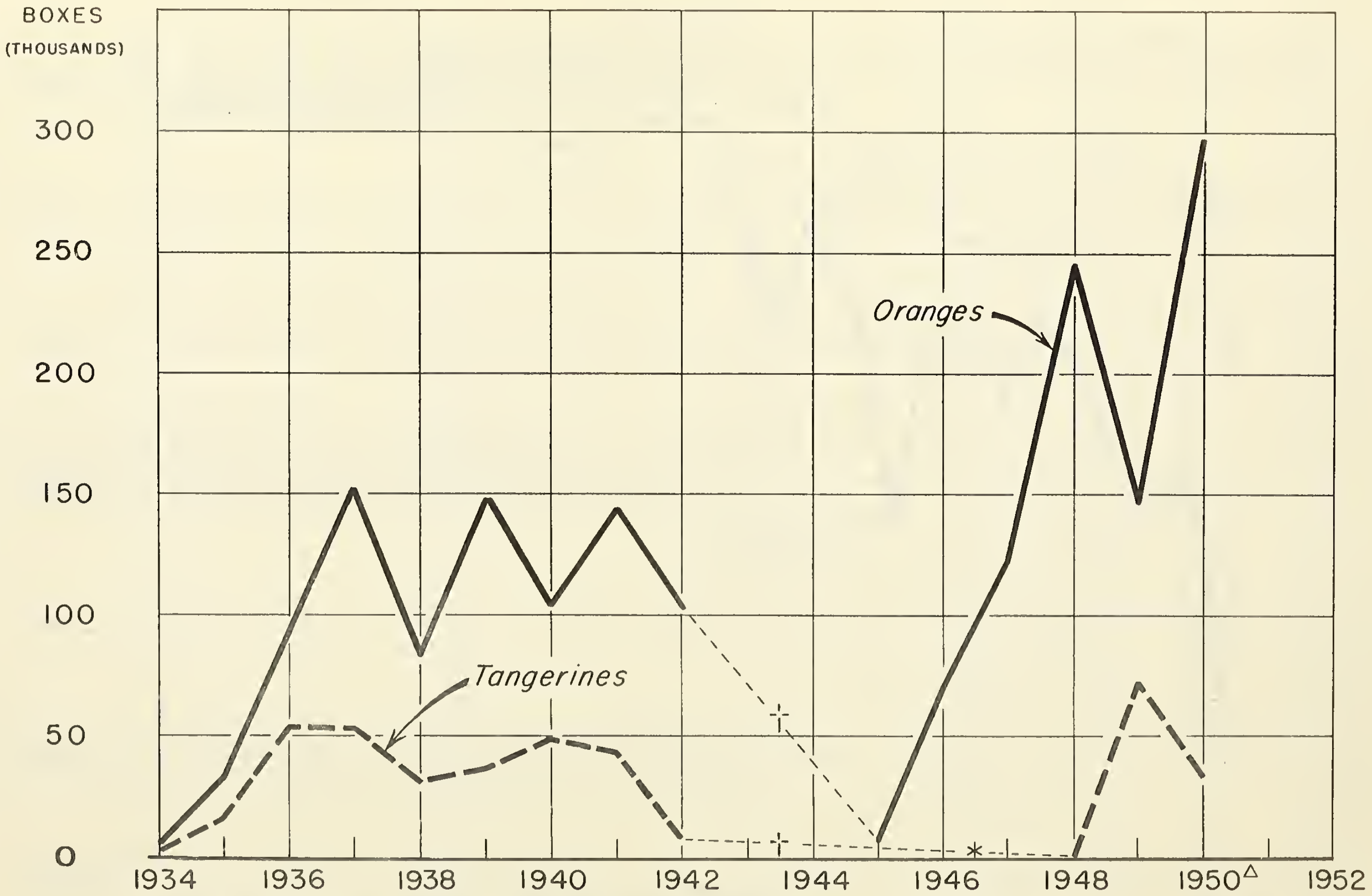
OFFICE OF FOREIGN AGRICULTURAL RELATIONS

TUNISIA: EXPORTS OF ORANGES AND TANGERINES*
1934-1950



*1945, 1946 AND 1947 TANGERINES INCLUDED WITH ORANGES

†NO DATA

△6 MONTHS

U S DEPARTMENT OF AGRICULTURE NEG. 1757 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Citrus Districts

The primary citrus-producing areas of Tunisia are on Cape Bon Peninsula, near Soliman, Menzel Bou Zelfa, Grombalia, and Beni Khaled. These areas have approximately 60 percent of all of the citrus acreage in Tunisia. Other citrus districts are located on the south side of Cape Bon near Hammamet and Nabeul, including the district near Beni Kriar. These are coastal plantings occurring within one mile of the sea and are located on a light, sandy soil. Because of the very high wind hazard, all plantings are surrounded by windbreaks composed of Italian cypress or rows of cactus planted on ridges surrounding each section of the groves. In this coastal area lemons were observed to do exceptionally well; however, the tallest branches of the trees protruding above the windbreak protection were often defoliated, and some dead wood was observed.

Cultural Practices

The discussion of cultural practices will be confined to European-operated orchards which produce the fruit entering into international trade. Since about 60 percent of the orchards are operated by Tunisians, however, a few comments are in order on the general nature of the native orchards. The native plantings are usually mixed and many varieties are planted in the same area. The native orchards of Tunisia are a very rich source of genetic strains of citrus, since they raise seedling trees rather than propagated stock. It is stated by well-informed people in Tunisia that red-pigmented, navel-type oranges and lemons may be found; the red-pigmented lemons are grown in the coastal areas near Hammamet. The native groves are planted very close together with the limbs interlocking; the lower limbs are removed to a height of about 5 or 6 feet so that one may easily walk under them in complete shade. This type of planting has some advantages in Tunisia since it no doubt reduces the wind damage.

The native orchards are cultivated by hand, and in some cases they are irrigated without mechanical-powered pumps. Large wells approximately 8 feet in diameter are dug and lined with stone. The water is raised from the wells in skins which are drawn to the surface by animals. A pole arrangement by the side of the cistern empties the skin when it reaches the top, the water flowing into a ditch which carries it to the area to be irrigated.

Labor (European Groves)

Farm labor in Tunisia is performed by natives. On one 57-hectare ranch, 20 hectares of which are in citrus, as many as 50 persons may be employed at one time. Employment, however, is intermittent. It is a native custom to work until sufficient money has been accumulated and then to quit until the need again arises. Wages are approximately

160 francs (50 cents) per day. Foremen and overseers are furnished houses on the ranch while natives live in their accustomed accomodations. Cultivation is done by single plowing, and little tractor power is used. The plowing and hoeing require a very great amount of hand labor.

Windbreaks

The plantings are usually surrounded by a windbreak on all four sides, and lateral windbreaks are planted every 6 to 8 rows within the grove. Thus, each orchard is divided into rather small squares, and a 40-acre grove may be composed of 25 or 30 small plantings surrounded by windbreaks.

Wind is a greater hazard in Tunisia than in any other citrus district visited in North Africa. On some of the larger plantings cypress trees are utilized as windbreaks, and even an occasional eucalyptus tree is found. Windbreaks may also consist of cactus planted on ridges about 5 feet high around the grove. The cactus fruit is very much appreciated by the native population in Tunisia and is the major fruit available for sale during the summer and fall months. However, these cactus windbreaks have a disadvantage. Since they are a host for the Mediterranean fruit fly, they bring large populations of the fly near the citrus plantings.

Root Stocks

Sour orange root stock is standard throughout Tunisia in spite of the light soil. There has been no evidence of any quick decline in the area, and apparently little experimentation has been done with sweet root stocks. In some groves experimentation has been carried on by budding lemon on sour root stock and then budding sweet orange on the lemon, making a "sandwich" of the lemon at the bud union, in hopes of eliminating some of the difficulties of the incompatibility of sweet orange with sour orange root.

Nurseries

No commercial nurseries as such were observed in Tunisia. On one large grove visited all the trees were raised in the grove. Since the majority of the citrus orchards are operated by Tunisians and some of these plantings are not from propagated stock, the citrus nursery industry can be considered an on-farm operation.

Citrus Diseases

Very little citrus disease was observed. A great deal of the Tunisian plantings are from native varieties, and no outbreak of psorosis was observed in the groves visited. Although some of the trees were over 20 years of age only one outbreak of gummosis was observed. "Oak root" fungus or armillaria is present in Tunisia but is most active on the cypress windbreaks which are particularly susceptible to this fungus. Even though infections of this fungus may be present in the windbreaks, growers state that it is seldom transmitted to the citrus trees. Growers state that there is no mal secco in Tunisia, and none was observed. Most orchards visited seemed to be very free from citrus diseases. Trunks of trees are frequently whitewashed, but this is primarily for protection against sunburn.

Irrigation

In the arid climate of Tunisia irrigation presents one of the most important problems of the citrus grower. Water for this purpose is limited in quantity and not always satisfactory in quality.

Unlike the high water table in most Algerian citrus areas, the water table in Tunisia is at least 12 feet below the surface in most areas. The orchards are irrigated with pumped water. Half of the pumping power is obtained from electricity and the other half from gasoline or diesel motors. In most areas water is found at three levels, each separated by layers of tight blue clay. In the Cape Bon region it is common to find the first level at 18 to 24 feet, the second at 45 feet, and the lower level at 120 feet. The water content of the first level varies with the rainfall and is sometimes exhausted, during drought.

Wells at the first level are large, open, circular pits which are stone-lined and may be 12 feet in diameter. Often the pump is placed near the surface of the water. Some growers state that one-third of the cost of culture is irrigation, and during the summer it may be necessary to apply about 1 cubic meter of water per tree every 10 days. Irrigation systems seem to be well laid out; some have open ditches and others concrete pipe. Water is applied in basins around the trees, the water being brought to the basin by a temporary ditch. Furrow irrigation cannot be used because of the light soil.

The availability of water is a definite limitation to citrus plantings. An irrigation project is being developed in Souk el Arba and the Medjerdah and other adjacent areas which it is estimated will bring under irrigation an additional 300,000 acres and will also furnish hydroelectric power to the region. Dams and other works in this project may be expected to be completed between 1955 and 1960.

In the vicinity of Tunis the pumped water may normally contain 2 to 3 grams of sodium chloride per liter. Higher concentrations may be found in some irrigation waters. In dry years this concentration increases, and groves have been known to be killed when the soil concentration of this chemical passes the tolerable limit.

Pests and Pest Control

Black, purple, and California red scale were all observed in visits to orchards. Red scale seems to be a major pest since the climate is particularly favorable for its development. No red spider was observed, and growers say that it is not present in this area. The Mediterranean fruit fly is the most important pest and becomes active in August. Its damage is usually visible by September, and the damaged fruit begins to drop in October. The activity of this pest stops later in the fall, at the beginning of the rainy season.

Depending upon the scale infestation, oil sprays are used once or twice a year. Treatment may be made between March and September. The spray machine used is rather small, the tank holding about 200 quarts. The wheelbases are very narrow in order that the vehicle may be pulled through closely planted groves. No towers are used since most of the trees are small, although on better soils some of the old trees may reach a height of 20 feet. No fumigation or dusting is used on citrus. The common spray mixture is a $1\frac{1}{2}$ percent solution of white oil. All spray applications must be concluded before September when the fruit begins to break in color.

Although the Mediterranean fruit fly is a major pest, no control measures are practiced in most groves. The application of sprays would be impractical because of the extensive windbreak plantings of cactus, which is a host to the fruit fly. The experiment station in Tunisia is investigating control measures; traps for the fly are placed in most trees in order that the extent of the infestation may be observed and the fly population reduced.

Varieties

Tangerines, lemons, and sweet and bitter oranges of many varieties are grown in Tunisia, and there are also small plantings of limes. In the new orange plantings two varieties of Maltese orange seem to predominate, the Portuguese semi-blood and the Maltese nonblood. These are oval-shaped oranges of high quality. Many of the other plantings of oranges in Tunisia are of native varieties, many of the same genetic strain as the navel.

In orchards visited, the Cadenera orange of Spain seemed to do particularly well, and the lemon and grapefruit trees showed exceptional vigor. The hot, dry climate seemed to be particularly suitable for the production of grapefruit.

Table 43, which gives the number of trees by kind and age group, indicates the nature of commercial Tunisian citrus plantings. The reduction in the number of trees between 1941 and 1943 was a result of the war.

The bitter orange plantings in Tunisia are used primarily for the production of nonfruit products such as neroli or orange-flower oil, orange-flower water, and petit grain. These nonfruit products also form a principal part of the native citrus culture.

Table 43. - Tunisia: Number of citrus trees, bearing and nonbearing, 1941, 1943, and 1945

Kind	1941			1943			1945		
	Bearing	Non-bearing	Total	Bearing	Non-bearing	Total	Bearing	Non-bearing	Total
	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Bitter orange.	35	341	376	37	165	202	155	144	299
Lemons........	72	88	160	82	78	160	104	53	157
Clementines...	9	37	46	11	28	39	24	18	42
Tangerines....	85	60	145	91	54	145	105	31	136
Oranges.......	388	392	780	427	353	780	510	268	778
Other citrus..	19	13	32	20	10	30	49	9	58
Total......	608	931	1,539	668	688	1,356	947	523	1,470

Source: Annuaire Statistique de la Tunisia, Annees 1940 a 1946, p. 100.

Fertilization

Manure and other organic material are used for fertilization as well as a fertilizer mix containing sulfate of ammonia, potassium, and phosphoric acid. A mix of 10-10-12 is in commercial use. The light soils require rather heavy fertilization for satisfactory culture, and older trees show evidence of malnutrition even though good fertilizer programs are followed. Most groves show evidence of manganese and zinc deficiencies; however, little or no treatment is carried on.

Because of the extremely light soils in citrus areas, growers seek to add as much humus material to the orchards as possible. Winter cover crops are planted, but they often need irrigation in order to bring them to maturity in periods of lighter-than-usual rainfall.

Another problem is to apply mineral fertilizers so that they will not be leached out of the soil by either rainfall or irrigation before the plant has had an opportunity to assimilate the plant food. For this reason, fertilizer is applied several times during the year rather than in one heavy application.

Experiment Station

A few miles outside the city of Tunis an agricultural experiment station is operated by the Service Botanique. At present, most of the station's work is on wheat and olives, which are the primary agricultural crops of Tunisia. By comparison, citrus is only a minor export crop. The director stated, however, that the station hopes in the future to be able to devote some additional time to work on citrus problems.

Marketing

The citrus produced in Tunisia is primarily for local consumption, and exports have not taken any considerable percentage of the crop until the last 2 or 3 years. From tables on production and exports published in La Tunisie Agricole in 1947 it may be calculated that approximately 1 percent of production was exported in 1945, 9 percent in 1946, 15 percent in 1947, and, according to preliminary estimates made at that time, approximately 34 percent of the 1948 crop would be exported.

Picking and Packing

In the European groves visited, the picking was performed by the growers, and clippers were used for cutting the stems. The fruit is usually transported to the packing house in field boxes which contain approximately 66 pounds of fruit. The hauling may be done either by the grower or by the packing house, and motor trucks are used for this purpose.

The citrus fruits for export are packed in a cooperative packing house near the city of Tunis.

At the packing house visited, modern machinery was in use; the fruit was washed in a borax solution, dried, waxed, and sized, dropping into large circular bins similar to apple packing bins. Women then barepack the fruit in California-style, two-compartment boxes and the traditional billot (an oval basket with tape red sides). The fruit is pattern-packed, and the packers are paid from 27 to 34 francs (US$0.08 to US$0.11) per hour. The boxes are made from French shook and cost 120 francs (US$0.38) each.

The oranges observed were of excellent quality. No crystallization was seen in February 1949, even on rough fruit with an elongated stem end.

Fruit Prices

According to growers, the price of lemons to the grower varies considerably with the season. Fruit sells in the orchards at 10 to 20 francs per kilo (US$0.01 to US$0.03 per pound) in winter, and at approximately 30 francs per kilo (US$0.04 per pound) in summer. In August 1949 when lemons were selling at approximately 30 francs per kilo on the tree, the retail price in Tunis was approximately 60 francs per kilo (US$0.09 per pound). Growers also stated that the average on-the-tree price for oranges in recent years has been approximately 20 francs per kilo (US$0.03 per pound).

In the European lemon groves, some of the fruit is not picked until it is very large, and some fruit was seen that was nearly 3 inches in diameter. This is done because the Tunisian market pays a premium for large lemons.

Exports

The export of fresh citrus from Tunisia has been of importance only in the last few years. These exports consist primarily of oranges and tangerines. From 1934 to 1942, exports of oranges were greatest in 1937 when slightly over 150,000 boxes were shipped; during this same period exports of tangerines were greatest in 1936 when slightly more than 50,000 boxes were exported. No exports were made in 1943 or 1944 because of the war. When the Germans were driven out of North Africa they retreated to Cape Bon through the Tunisian citrus orchards en route to the Mediterranean and Sicily. Since 1945, exports have been resumed, and total exports of oranges and tangerines have increased rapidly by comparison with prewar years as illustrated in table 44 and the chart on p. 118.

Due to the large percentage of groves operated by Tunisians, it may be anticipated that exports will continue to be on a small scale. Citrus exports are unlikely to exceed one-half million boxes of oranges and tangerines and 100,000 boxes of lemons a year during the next 10 years.

Tunisia exports primarily to France; however, in 1950 small exports were made to Western Germany.

Table 44. - Tunisia: Exports of oranges, tangerines, and lemons, 1934-50

Year	Oranges	Tangerines	Lemons
	Boxes	Boxes	Boxes
1934	5,373	2,797	
1935	32,682	15,230	
1936	91,885	53,099	
1937	152,939	52,495	
1938	83,447	31,822	
1939	147,837	37,560	
1940	103,528	48,844	
1941	143,060	43,890	
1942	103,289	8,604	
1943	0	0	
1944	0	0	
1945	1/ 6,686	2/	
1946	1/ 69,618	2/	
1947	1/ 121,373	2/	
1948	244,941	412	52,150
1949	146,521	71,835	40,124
1950 3/	297,293	33,434	45,803

1/ Includes tangerines.
2/ Included with oranges.
3/ Six months.

Source: Official sources and consul reports.

Freight Rates

In exporting oranges to France, the fruit is shipped from Tunis to a French port such as Marseilles and then transferred to rail cars for shipment to Paris. The freight rates from Tunis to French ports are the same as those from Algeria, although the distance is somewhat longer.

Since the rail freight rates depend upon the size of the rail car used, the cost of transporting fruit from Tunis to Paris varies from $0.91 to $1.16 per box (see table 45).

Table 45. - Sea and rail rates, Tunis to Paris via Marseille 1/

Item	Rate per metric ton	Rate per box
	French francs	United States dollars 2/
3-ton rail car		
Sea freight	4,180.00	0.41
Port tax 3/	61.50	0.01
Rail freight	7,493.00	0.74
Total	11,734.50	1.16
5-ton rail car		
Sea freight	4,180.00	0.41
Port tax 3/	61.50	0.01
Rail freight (5-ton car)	5,414.00	0.54
Total	9,655.50	0.96
8-ton rail car		
Sea freight	4,180.00	0.41
Port tax 3/	61.50	0.01
Rail freight	4,898.00	0.49
Total	9,139.50	0.91

1/ Unloading charges are not included.
2/ French francs converted to dollars at 320 francs to the dollar.
3/ Includes a transaction tax of 1.50 francs per metric ton.

Source: Sea rates - Societe Commerciale Tunisienne, Tunis. Rail rates supplied by Office of Agricultural Attache, American Embassy, Paris.

Cost of Production

The cost of production is always a difficult subject in any citrus industry, and Tunisia is no exception. The cost estimates in this section apply only to European-operated groves which supply most of the export fruit. The cost of operation of the Tunisian-owned groves may be assumed to be considerably less than that of the European-operated groves, but the quality of the product is also poorer, which might tend to compensate for a competitive advantage on the basis of production costs.

Yield

Yield data for three European-operated citrus groves are given in tables 46 and 47. Grove X, which shows yields of 581 boxes per acre in 1947-48 and 414 boxes per acre in 1948-49 should not be considered as representative of Tunisian citrus culture. The lower yields given for Groves Y and Z should be considered as more representative. The effect of climatic disaster is indicated in these yield figures, notably the reduction in yield in 1940-41 because of the severe frost and also the reduction in yield in 1948-49 in Groves Y and Z because of the severe windstorm which occurred at that time. Of the three North African citrus districts, the war affected Tunisia most, and during the final stages of the North African war the operation of citrus groves was stopped completely. Since the groves were occupied by a hostile force for a considerable time, they suffered markedly for lack of care. General observation in all of the European Tunisian citrus groves visited indicated that the yield per acre is very much less than in Algeria or Morocco.

Cost of Operation (European Groves)

Estimates of the cost of grove operation in 1949 varied from 75,000 to over 100,000 francs per hectare. A breakdown of one of the higher estimates is given in table 48. Although the cost of production is figured at 260,000 francs per hectare (US$328.81 per acre) the cash costs of actual operation are only 126,000 francs per hectare (US$159.35 per acre). The balance of the cost is made up of interest and amortization, travel and general expenses, and managing expenses. This method of accounting is quite customary in all North African citrus districts.

Tunisian growers stated that taxation is applied on the basis of improvements and income. In 1947 a tax of 25 francs per tree over 7 years old was levied However, owing to the protests of growers, this may be reduced to 10 or 12 francs in the near future. There is also a tax on personal property such as carts and animals. In addition to this, the grower pays an income tax which is scaled in approximately the same manner as the United States income tax.

Table 46 - Tunisia: Citrus yields at groves X and Y

Season	Grove X 1/ (18 years old in 1949)		Grove Y 2/ (35 years old in 1949)	
	Quintals per hectare	Boxes per acre	Quintals per hectare	Boxes per acre
1939-40	104	133		
1940-41	60	3/ 77	105	134
1941-42	220	281	128	163
1942-43	180	230	93	118
1943-44	4/	4/	98	125
1944-45	87	111	114	145
1945-46	214	273	220	280
1946-47	287	366	185	236
1947-48	456	581	160	204
1948-49	325	414	135	172

1/ This grove is planted primarily to Maltese but also contains Valencias and navel oranges, clementines, tangerines, and lemons. The age of the trees ranged from 2 to 30 years, and averaged 18 years in 1949. The grove is located on Cape Bon on deep alluvial soil. It is planted 200 trees to the hectare (81 trees per acre).

2/ This grove contains clementines, Maltese oranges, and lemons planted 300 trees to the hectare (121 to the acre). The trees were 35 years old in 1949. The grove is located in the northern part of Cape Bon.

3/ Reduction of the crop in 1940-1941 is due to frost.

4/ Abandoned.

Source: Information furnished by a citrus grower.

Table 47. - Tunisia: Citrus yield at grove Z

Season	Age of grove in 1949									
	12 years		25 years		25 years		11 years		30 years	
	Clementines		Tangerines		Maltese		Navel		Lemons	
	Quintals per hectare	Boxes per acre	Quintals per hectare	Boxes per acre	Quintals per hectare	Boxes per acre	Quintals per hectare	Boxes per acre	Quintals per hectare	Boxes per acre
1939-40......	15	19	90	115	58	73	---	---	44	56
1940-41......	47	60	128	163	65	83	6	7	35	44
1941-42......	40	51	100	128	92	117	13	17	60	77
1942-43......	44	55	130	166	39	49	20	26	74	94
1943-44......	22	27	64	82	46	58	21	27	47	59
1944-45......	43	55	192	245	46	59	31	40	60	77
1945-46......	55	70	64	82	123	156	44	56	108	138
1946-47......	57	73	126	161	95	121	80	102	65	83
1947-48......	105	134	180	229	153	195	80	102	150	191
1948-49 1/..	20	26	12	15	43	55	47	60	39	50

1/ Crop reduction in 1948-49 is due to damage to the grove suffered in a wind storm in December 1947.

Source: Information furnished by a citrus grower.

Table 48. - Tunisia: Cost of citrus fruit production 1947-48

Item	Francs per hectare	U. S. dollars per acre 1/
Fertilizer:		
Chemical, 9 quintals @ 200 francs per quintal	18,000	22.76
Organic, 20 metric tons at 850 francs per ton	17,000	21.50
Total, fertilizer	35,000	44.26
Labor:		
2 workmen, 4 months a year	26,000	32.88
Foreman mechanic and overseer	9,000	11.38
Total, labor	35,000	44.26
Petroleum products:		
500 liters of gasoline and 20 liters of lubricating oil for stationary engines	12,500	15.81
Transportation of crop and miscellaneous	5,500	6.95
Total, petroleum products	18,000	22.76
Pest prevention treatment:		
White oils, 50 liters, miscellaneous copper treatments	8,000	10.12
Equipment--(Amortization and repairs)	20,000	25.29
Buildings--(Amortization and upkeep)	20,000	25.29
Watchmen--(4 watchmen, 6 months per year)	6,000	7.59
Livestock--(Feed and upkeep)	7,500	9.49
Miscellaneous taxes	7,000	8.85
Miscellaneous expenditures:		
Traveling and general managing expenses	32,000	40.47
Amortization of trees (in 40 years)	12,000	15.18
Interest on capital invested (5 percent) (not accepted by tax office)	50,000	63.23
Insurance premiums	9,500	12.02
Grand total	260,000	328.81

SUMMARY

Item	Francs per hectare	U. S. dollars per acre 1/
Cost of operation	126,000	159.35
Managing expenses:		
Interest and amortization	102,000	128.99
Traveling and general	32,000	40.47
Total, Managing expenses	134,000	169.46
Grand total	260,000	328.81

1/ Converted at 320 francs to US$1.00.

Source: A cost study prepared by a group of Tunisian citrus growers for their own use.

The cost of production in Tunisian groves may be calculated as follows considering the cost and yield factors shown below. The costs of operation are cash costs and do not include amortization.

	High	Low
Cost of operation:		
Francs per hectare	126,000	75,000
Dollars per acre	195.35	94.85
Average yield:		
Kilos per hectare	15,000	7,500
Boxes per acre	191.2	95.6
Cost of production:		
Francs per kilo	10.00	8.40
Francs per 30-kilo box	300.00	252.00
Dollars per 66-pound box	0.94	0.79

Break-even Costs f.o.b., Tunisian Ports

If we consider that the costs of picking and packing are the same as for Algeria, the break-even costs f.o.b., Tunisian ports may be calculated as follows:

	High	Low
Cost of production:		
Francs per kilo	10.00	8.40
Dollars per box	0.94	0.79
Cost of picking and packing:		
Francs per kilo	12.60	9.10
Dollars per box	1.18	0.85
Transport to port:		
Francs per kilo	0.50	0.50
Dollars per box	0.05	0.05
Total:		
Francs per kilo	23.10	18.00
Dollars per 66-pound box	2.17	1.69

In computing the break-even costs for Tunisia a plausible range of factors has been chosen. Yield per acre is lower than in either Algeria or Morocco, and this is indicated by the grove yield records. It is true that in some years yields are higher than the range used, but this is offset by lower yields in other years. The high yield of 300 or more boxes per acre is not characteristic of Tunisia with its small trees and sandy soil.

Methods of cultivation are reflected in the selection of the range of costs of operation. The light soils and the strong Italian influence are probably responsible for the cultural practices in Tunisia. Tunisian growers use horses for cultivation, and tractors are not used to such a great extent as in Algeria and Morocco. Animals can be used more efficiently on light soils than on heavy soils. Tunisian groves have considerably less capital equipment than either Moroccan or Algerian orchards.

The lower yields and the damage caused by wind, frost, and drought make for higher production costs than in other parts of North Africa. For this reason Tunisia is not likely to be important in international trade in oranges.

Processing

A modern plant in Tunis, which is equipped with American-made machinery, is canning orange, lemon, and grapefruit juice. The primary product is orange juice, and small oranges and culls are utilized for this purpose. The oranges are automatically juiced by a machine which also extracts the oil from the peel. The juice is filtered, flash pasteurized, and placed in steam-sterilized cans which are closed automatically. The tins are cooled after capping without additional steam sterilization.

The cans for use in Tunisia are made by a local plant, and the tops and plate are obtained from France.

The plant visited was making some utilization of byproducts, such as orange oil. It was also preparing to utilize the juiced hulls for cattle feed, and a revolving drum to dehydrate the orange peel and pulp for this purpose was nearing completion.

This plant was also producing single-strength juice for use in the English squash industry. For this purpose small oranges obtained from the "pony sizer" were being cut by hand and juiced at tables containing hand reamers. The children who do this work receive 14 francs (US$0.04) per hour, or they may earn 27 francs (US$0.08) per hour on a piece work basis. The half orange to be juiced is picked from the tray and is applied to the spindle in much the same manner as oranges are juiced on American home electric juicers. The juice runs down into a trough which carries it to a collecting receptacle from which it is transported by hand to a 600-gallon tank mounted on a rubber-tired chassis. The raw juice is screened to remove large seeds and pulp. The juice is shipped in casks which hold approximately 100 gallons. These casks are steam cleaned and waxed before they are filled with juice from the tank-wagon. Bottled sulfur dioxide gas is then bubbled through the raw juice as a preservative before the lid is applied. This juice is sold at 5 shillings (US$0.70) per imperial gallon c.i.f., London, although only 25 shillings (US$3.50) is offered for a 65° Brix concentrate which is equivalent to about 6½ gallons of raw juice.

The processing plant observed in Tunisia has the capacity of canning 50 No. 2 cans per minute. However, it was stated that this capacity could not be realized over long periods of time since the extracting apparatus could not furnish enough juice.

Varieties of Processing Fruits

One of the problems of the processor at Tunis is the variety of fruit which is handled. At the time the plant was visited, it has just received a shipment containing at least five varieties of lemons. The plant also receives a tremendous number of orange varieties, since a large portion of the Tunisian orange production is in the hands of native Tunisians who raise a large percentage of their trees from seedlings.

Testing Tunisian Citrus Juices

Samples of citrus juices were obtained in Tunisia, and these were later tested in Washington by the Standardization and Inspection Division of the Fruit and Vegetable Branch of the Production and Marketing Administration, United States Department of Agriculture, according to the Department's standards for citrus juices (see table 49). These samples of orange, lemon, and grapefruit juice may be considered as characteristic of the type of product now being produced.

The presence of the Mediterranean fruit fly in the North African citrus areas adds to the problem of the processor in controlling the quality of the juice which is produced.

Nonfruit Processed Products

In Tunisia, as in Italy and Spain, there is a nonfruit citrus processing industry which produces essential lemon oils, neroli or orange-flower oil, orange-flower water, and petit grain. Neroli is obtained by distilling the vapors given off when bitter orange flowers are boiled. The commercial products are obtained from the process of distillation. The oil which appears as a thin layer on top is drawn off and is the product neroli, used in perfumes. The remaining product is a clear, scented water known as orange-flower water; this is also utilized in perfumes and toilet waters, and the filtered product is used for medical purposes to treat nervous disorders.

Table 49. - Analysis of canned citrus juice from Tunisia

Analysis category	Unit	Orange	Lemon	Grapefruit
Date of analysis		December 7, 1949	December 9, 1949	December 2, 1949
Size of can	Inches	3-1/2 x 4-3/16	3-8/16 x 4-5/16	3-5/16 x 4-5/32
Fluid measure	Fluid ounces	18	18.3	19.3
Vacuum	Inches	10	7	3 (can dented)
Density	Degrees Brix	14.5°	9.2°	11.0°
Anhydrous citric acid per 100 ml.	Grams	1.33	5.6	1.88
Pulp	Percent	8	10	7
Recoverable oil by volume	Percent	0.01	Trace	Trace
Ascorbic acid per 100 ml.	Milligrams	38.22	43.17	32.71
Color		Good	Good, typical	Fairly bright, trace of brown
Absence of defects		Good	Good	Markedly free
Flavor		Fairly good, peculiar to product	Slight terpine flavor	Poor. Sharp and acrid
Ratio of soluble solids to citric acid		10.9:1		5.86:1
U. S. grade		C or Standard	Not certified	D or Substandard
Comments		Grade account of flavor	No grade account of insect and maggot particles. Would otherwise be U. S. grade C or Standard account of flavor	Grade account of high citric acid and ratio of solids to acid which is reflected in flavor

Tested by Standardization and Inspection Division, Fruit and Vegetable Branch, Production and Marketing Administration of the United States Department of Agriculture, Washington.

Operators stated that the orange flowers are purchased at a price of 40 to 50 Tunisian francs per kilo (US$0.06 to US$0.07 per pound). The orange trees are beaten with canes to shake the blossoms on to a canvas which is placed under the trees. Approximately 1,000 kilos (2,205 pounds) of orange flowers produce approximately 1 kilo (2.2 pounds) of neroli and 500 kilos (1,102 pounds) of orange-flower water.

Trade estimates place neroli production at approximately 160 to 180 kilos (353 to 397 pounds) per year. In 1949, the market price of neroli was approximately 60,000 francs per kilo (US$85.05 per pound). At that time the wholesale price of orange-flower water was 20 to 40 francs per liter (US$0.06 to US$0.12 per pound), and the retail price was 200 francs per liter (US$0.28 per pound).

In order to produce satisfactory neroli the plantings of the bitter orange must be quite concentrated since the pollenization of the flowers by bees will spoil the quality of the product if other citrus varieties are in the vicinity of the planting. In order to overcome this difficulty a new type of bitter orange called "bouquebier de Nice" is being imported into Tunisia from France. This bitter orange or bigaradier has the characteristic of maintaining its quality in the presence of other varieties.

Petit grain is produced by distilling the vapors obtained by boiling bitter orange leaves. The leaves are removed from the trees during the annual pruning, approximately one month before the blossoming period in the spring.

The essential lemon oil industry is located at Nabeul which, along with Hammamet, is in the center of Tunisia's primary lemon-producing area.

Neroli, orange-flower water, and petit grain are among the most ancient of citrus processed products. The Arabic peoples have long utilized these products as perfumes.

Conclusions

The citrus industry will probably not develop as rapidly in Tunisia as in Algeria, owing to the large proportion of native holdings. Because of the wind hazard, the poor water supply, the activity of the Mediterranean fruit fly, and the generally small size of the trees and poor light soil, production is not likely to increase even on new plantings, and production costs will probably remain high.

In 1950-51 Tunisia produced over 1 million boxes of oranges and about 200,000 boxes of lemons, the largest crop on record. As new acreage comes into bearing, production may increase in the next 10 years to 1.5 million boxes of oranges and 300,000 boxes of lemons, but it is unlikely to exceed these figures.

If production should reach these indicated maximums, exports may increase above present levels. Total citrus exports, however, are unlikely to exceed half a million boxes in any year in the next 5 years. With freight rates comparable to those from Algeria and Morocco and a higher cost of production, Tunisia is in the poorest competitive position of the three districts.

The processing industry will remain small. Some citrus juice products will be exported in casks and pasteurized cans, but neroli, orange-flower water, and petit grain will probably be more important. With the exception of Spain, Tunisia is one of the largest producers of nonfruit processed products.

APPENDIX I

Regulations Governing the Packing and Export of North African Citrus Fruit
(Excerpts from Government Decrees and Orders)*

I ALGERIA

(c) Citrus Fruits (exportation)

Order of April 20, 1939
establishing the rules applicable to the standardization of citrus
fruit upon export from Algeria

Title 1. --General Provisions

Article 1.--Under the conditions and sanctions provided in Article 5 of the Decree of December 23, 1936, it is prohibited to export citrus fruits of Algeria which do not meet the specifications of this Order.

Article 2.--All designations generally employed in commerce and trade in order to describe a specific quality such as "super-choice," "first quality," "superior," etc., may not appear inside or outside the boxes. Only the designations as provided by this Order are authorized.

They may be reproduced inside the containers.

The forwarding agents are free to add their own trade mark provided it does not contain any indication of being in conflict with the provisions of this Order.

Title 2.--Minimum Conditions Necessary for Exportation

Article 3.--(a) Quality.--In order to be approved for export, the citrus fruits of Algeria must be healthy, of good quality, and marketable, and free from visible and deep bites of the fruit fly.

It is prohibited to ship boxes containing products seriously affected by frost, sirocco (a hot desert wind) or other climatic factors, insects and diseases, or manure, as well as those showing traces of moisture or decay, or of injuries which might impair their preservation.

Only ripe, juicy, fresh, firm citrus fruit may be shipped. For "marketable" quality an allowance of 5 percent is made for fruit not meeting these requirements.

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* Source: Annuaire des Agrumes Nord-Africaines, Algiers, 1948. These excerpts were translated from the French by Elizabeth Haunian, translator for the Library of Congress under the direction of Mr. W. C. Gilbert.

(b) *Maturity*.--Citrus fruit is considered ripe when the ratio of soluble solids to citric acid in the juice is at least equal to the following schedule:

Oranges of designated varieties: 7:1 with a minimum Brix degree of 9.5
Oranges, not specified: 6:1 with a minimum Brix degree of 9.5
Tangerines: 6:1
Clementines and satsumas: 7.5:1

The skin of the clementines and satsumas must at least be lightly turned (the green peel beginning to turn yellow).

The pomelos must be colored all over a light yellow.

(c) *Juice*.--Qualified as juicy are those citrus fruits whose weight of juice, expressed in general terms, is at least equal to:
1/5 of the weight of the whole fruit, for oranges;
1/3 of the weight of the whole fruit, for mandarins, satsumas, clementines.

(d) *Conditioning*.--All boxes must be alike in makeup as to variety, quality, maturity, coloration, etc. Soaking of products and wrappings, use of straw, wadding and printed or plain paper are rigorously prohibited.

The fruit must be protected, at the bottom and at the top of the containers, by fibrous layers separated from the fruit by small cardboard boxes.

The fruit is arranged in regular layers and separated by small cardboard boxes. This method is optional for tangerines, clementines, and satsumas, with a diameter of less than 48 millimeters, as well as for oranges and pomelos packed in California-type crates.

(e) *Stems*.--The stems must adhere to the fruit and be neatly cut off at sepal height.

(f) *Presentation*.--For "extra" quality it is obligatory to adorn the top layer of the fruit with diverse ornaments, such as "suns," "godets," curls, or fringes. This provision is optional for "standard" quality, but prohibited for "marketable" quality.

(g) *Identification*.--All boxes must bear on the outside, on the body of the container, the complete name and address of the forwarding agent: name, first name, location, department, and street name, if any, or even the identifying code required under the law (Service de la Repression des Fraudes); these inscriptions must be in readable letters of at least 2 centimeters in height, marked in indelible ink or burnt on.

The cleats of the boxes or the tops of the crates or boxes, must be provided with the color designating the forwarding agent.

(h) Sorting.--The citrus fruit is shipped, after being sorted as to quality, under one of the following designations: "extra," "standard," or "marketable."

Title 3.--Qualities

"Marketable" Quality

Article 4.--Healthy, good-quality, marketable, ripe, juicy, and fresh citrus fruit may be offered as "marketable" quality.

The fruit must be shipped, sized or non-sized (all sizes):

(a) Sized: Fruit meeting the specifications set forth in Article 8.

(b) Non-sized or "all sizes": Fruit not graded by wholesaler. The only approved sizes are those defined in Article 8. The symbol "T-V" must be inscribed on the boxes, in letters 4 centimeters in height. An allowance of 5 percent is made on fruit not meeting these specifications.

"Standard" Quality

Article 5.--Under the designation "standard" are shipped healthy, good-quality, marketable, ripe, juicy, firm, cleam, well-shaped citrus fruits showing neither spots nor deep injuries of the skin, and free from parasites.

"Standard" oranges must measure at least 56 millimeters in diameter (size 7);

"Standard" tangerines, at least 48 millimeters in diameter (size 6);

"Standard" clementines and satsumas, at least 48 millimeters in diameter (size 6);

"Standard" lemons, at least 48 millimeters in diameter (size 7).

Eliminated is soft, misshapen fruit bearing traces of manure earth, caked insecticide, or showing puffiness or deformation, and cochineal bites.

Allowance: An allowance of a maximum of 10 percent in weight is made on fruit bearing very superficial epidermic scars if they have no harmful effect on keeping quality or taste.

These scars may not measure over 5 centimeters in length for oranges, lemons, and grapefruit, and 4 centimeters for tangerines, clementines, and satsumas.

"Extra" Quality

Article 6.--Under the designation "extra" are shipped healthy, good quality, marketable, ripe, juicy, firm, well-shaped, perfectly colored fruits, which are free from skin blemishes and have a thin or semi-thin skin, depending on the species and varieties, adherent to the fruit.

Oranges must measure at least 56 millimeters in diameter (size 7)
Tangerines, 48 millimenters, (size 6)
Clementines, 48 millimeters, (size 6)
Lemons, 48 millimeters (size 7)

Only those oranges whose varieties are listed in Article 8, with the exception of "other varieties, not designated (miscellaneous)," may be properly designated as "extra" quality.

Satsumas are not included in the "extra" category.

The fruits must not have swelling, deformities, or defects visible to the eye. In addition, they must possess the specific characteristics of their variety.

Allowance: A maximum allowance of 3 percent is made for fruit with superficial blemishes and scars, slightly larger *, whose presence cannot harm their keeping qualities or taste.

Trademark "Algeria"

Article 7.--The trademark "Algeria" must be placed on the boxes of citrus fruit answering to the specifications under "extra" quality.

Title 4.--Classification

Article 8.--It is obligatory to classify for shipping, by commercial types or varieties and according to their weight, the citrus fruits of Algeria which meet the specifications set forth in Articles 5 and 6.

(a) Commercial types: The fruit is classified and designated according to the following table:

Oranges	Code
Washington Navel	W
Thompson Navel	T
Maltese, fine	M
Portuguese semi-blood	P
Valencia Late	V
Cadenera	C
Sanguine ronde (blood round)	S
Jaffa	J
Brazilian	B
Golden Buckeye	G
Other varieties, not designated (miscellaneous)	D

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* May possibly be, instead of "de peu d'etendue," "de peau d'etendue"--tightly stretched skin.

Mandarins (tangerines)	Code
Clementines	Ma
Satsumas	Cl
Citrons (lemons)	Ci
Pomelos (grapefruit)	Po
Kumquats (round)	KR
Kumquats (long)	KL

(b) Size: The size of the fruit, measured horizontally, is designated by the caliber code in the accompanying table:

. . .

Not approved for shipment are:
Oranges measuring less than 48 millimeters in diameter.
Tangerines measuring less than 41 millimeters in diameter.
Clementines and satsumas measuring less than 35 millimcters in diameter.
Lemons measuring less than 41 millimeters in diameter.

Oranges shipped in boxes labeled "Californiennes": The caliber code number is replaced by a figure indicating the number of oranges contained in the box.

Pomelos (Grapefruit) and Kumquats: No caliber code symbol is assigned to shipments of pomelos and kumquats, but the fruits must be sorted as to size in order to make up boxes of homogeneous appearance.

Allowance:

Oranges: 6 percent in weight, on slightly inferior sizes.
Tangerines, clementines, satsumas, and lemons: 10 percent in weight, on slightly inferior sizes.

II. TUNISIA

Standards for Citrus Fruits of Tunisia

(Tangerines, Clementines, Oranges, Lemons, Pomelos [Grapefruit])

Article 1.--The exportation of Tunisian citrus fruits which do not fulfill the following conditions is prohibited on the basis of the conditions and under penalty of the sanctions set forth in the Decree of July 19, 1939.

Article 2.--Quality and aspect. The oranges must have uniformly acquired the specific coloration which denotes ripeness of the fruit. At least two-thirds of the surface of the tangerines and clementines must be colored with their specific coloration, the remainder presenting a beginning of turning, without any green spot. No typical coloration will be required for lemons, but the fruit must be sufficiently juicy.

All exported fruits must be well-shaped, firm, healthy, of good quality, and marketable, free from scars or defects, diseases, or parasites visible or apparent at the time of the checkup.

The following fruit is not acceptable: misshapen fruit, presenting very pronounced skin granulations; fruit which has fallen or shows unhealed wounds; and puffy tangerines and clementines.

The stems must be removed by a sharp instrument, flush with the peel. Lemons may be offered without stems.

The boxes must contain only fruit of the same variety and of uniform size and quality. Fardage is rigorously prohibited, but it is permitted and even recommended that the fruit be offered best side up in such a manner that the most colored and most attractive surface meets the buyer's eye when the box is opened.

. . .

Article 4.--Packing. In order to prevent the fruit from tossing about in the containers, a pad of non-odorous shavings, covered over with cardboard is to be placed on the bottom of the crate, flush with the wood. The thickness of this pad should be calculated in such a way that the fruits of superior grade lie exactly flush with the sides of the container. The inner walls of the boxes are to be covered with a sheet of colored paper, preferably blue for oranges and orange-colored tangerines, violet for lemons, and green for clementines and blood oranges. The upper part of this paper is to be folded back upon the tier above when the wrapping is finished.

The fruit must be arranged inside the container on pads and the spaces between the fruit stuffed with non-odorous shavings of the same color as the paper lining the inner walls of the container. This provision is optional for fruits wrapped in tissue paper. Tangerines and clementines must not be placed sideways. The use of grass or hay, straw, or newspapers for proper conditioning is rigorously prohibited.

The only approved standard containers are:

(1) Boxes of 14 pouces, Mussy type, corresponding to a tare weight of 1.5 kilograms, whose volume is 17 cubic decimeters (for tangerines and clementines);

(2) Boxes of 16 pouces, Mussy type, corresponding to a tare weight of 2 kilograms, whose volume is 22 cubic decimeters (for oranges, tangerines, citrons, pomelos);

(3) Boxes of 18 pouces, Mussy type, whose volume is 35 cubic decimeters (for pomelos);

(4) Flat boxes, Mussy type, whose volume is, respectively, 13 and 18 cubic decimeters (for tangerines and clementines);

(5) Double-compartment standard California-type crates, measuring 630 x 290 x 290 mm., holding 33 to 35 kilograms gross weight. All these containers must be new, of perfectly smooth wood, dry, non-odorous, and without deforming knots, resin, worm holes, or traces of having been overheated.

Article 5.--Marking. The number of pieces of fruit contained in the shipment, indication of species, varieties, and size are to be marked on the end of the middle, inspection, plank of the boxes and on one of the short sides of the crates.

Indication of the species and varieties is given in the following code:

Clementines	O
Mandarins (tangerines)	M
Lemons	C
Navel Oranges	N
Maltese, semi-blood, oranges	MAS
Maltese oranges, regular	MAO
Jaffa oranges	J
Blood oranges, regular	S
Beldi Oranges	B

The marking is to be effected in grease paint; the letters are to stand out well and be at least 50 mm. in height.

Article 6.--Inspection Tag. An inspection tag bearing the registration number of the accompanying shipment is to be placed in each container on the top layer of the fruit.

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INSPECTION

Regulations applying to the control of the standardization outside of regular service hours

(Order of February 28, 1948, published in Journal Officiel Tunisien, No. 34 of April 20,1948)

1. The regular operating hours of the inspection services of the Office Tunisien de Standardisation (O.T.U.S.) are the hours provided in the decrees, orders, and rules and regulations for the customs service, and the hours for the disembarkation service as established by decision of the Director of the O.T.U.S.

2. The operations requiring the intervention of the inspection services of the O.T.U.S. may, in exceptional cases, be performed outside of the hours provided in the decrees, orders, rules and regulations, and decisions as per Article 1.

They respond to a request for special overtime work, which contains:

(1) Indication of the place, and the nature of operations to be performed, the starting time as well as estimated duration.

(2) Pledge to pay within 24 hours at the desk of the O.T.U.S. the fees due in accordance with the provisions of this decree.

3. The O.T.U.S. is the sole judge as to the number of agents to be placed on duty for each request for performance of service (operation).

. . .

III.--MOROCCO

Oranges

The exportation of oranges has been subject to regulations since November 1933.

An Order of November 9, 1933, fixing the conditions which the packed product must fulfill, was repealed by the Order of June 22, 1934.

By virtue of this latter Order, published in the B.O. No. 1132 of July 6, 1934, and extended indefinitely by the Order of D.A.E of June 20, 1938, amended by the Order of the Director of Economic Affairs of July 12, 1938, published in the B.O. No. 1342 of July 15, 1938, the oranges were actually placed under control.

Title 1.--General Control

Article 1.--The certificates of inspection relating to the shipments of oranges must state that the inspected goods meet the following requirements, upon nonfulfillment of which the customs service will refuse embarkation:

(1) Maturity and Aspect. At least two-thirds of the surface of the oranges must be colored with their specific coloration (that which the fruit presents in its state of maturity) and the remaining one-third must show the beginnings of turning, without any green spot.

However, the oranges may not be exported if the acidity of 10 cubic centimeters of their juice may be neutralized by 28 cubic centimeters of decinormal soda solution; those oranges qualify as ripe whose neutralization will require only 24 cubic centimeters of solution.

(2) Quality minima. All exported oranges must be perfectly shaped and healthy and have their stems cut off neatly at sepal height; rejected as unfit for exportation will be fruit which is misshapen or thick-skinned, which has dropped (from the tree) or presents imperfections caused by frost or sirocco, signs of internal or external parasites (particularly the fruit-fly), and unhealed wounds.

Fruit containing small healed lesions or a few minor defects which in no way impair its proper preservation may be exported.

(3) Size and classification. The exported fruits must have a minimum diameter of 57 mm., the classification will be made according to the following calibers:

. . .

"De luxe" oranges: Fruits of perfect skin granulation, shape, color, ripeness, with thin or semi-thin peel depending on variety, without any visible defect.

"Choice" oranges: Properly ripened and normally shaped fruits, with peel free of serious defects.

Conditioning: The containers must contain, bearing in mind the allowances below, only fruits of the same variety and quality, size, shape, and coloration, and, as nearly as possible, the same skin granulation.

Allowances: As to coloration and difference in skin granulation, the allowance will be 5 percent in number for "de luxe" oranges and 8 percent for "choice" oranges.

Boxing: Only the following containers are authorized:

Standard crate, California-type, 33 to 35 kilograms gross, with the following characteristics:

Crates in white wood:

2 ends: 290 x 290 x 15 mm;
1 center partition panel: 295 x 290 x 15 mm;
8 wall boards: 650 x 135 x 6 mm;
2 cleats: 290 x 15 x 9 mm.

Crates in sea-pine:

2 ends: 290 x 290 x 11 1/2 mm;
1 center partition panel: 295 x 290 x 11 1/2 mm;
8 wall boards: 650 x 135 x 6 mm;
2 cleats: 290 x 15 x 9 mm.

All containers used for the exportation of the oranges must be new, and made of perfectly smooth wood (peeled, cut, planed, or sawed thin), nonresinous, dry, and nonodorous.

Exceptions from the provisions of this Decree may be granted by the Director of the Office Cherifien de Control et d'Export for the utilization of special packing material to serve in "on approval" shipments or shipments not of a commercial nature.

(8) Wrapping*: All the oranges exported must be separately wrapped in tissue paper, colored or plain, and stamped with the name of the production area and the name of the producer.

The inside walls of the crates and boxes must be lined with glazed paper or cardboard; the layers of fruit separated by a layer of cardboard or fiber, and the top layer protected by a pad of fine fiber or cellophane or similar material.

The crates may contain oranges simply wrapped in tissue paper, without requiring additional wrapping.

The use of straw, grass or hay, or of printed paper in the containers is prohibited.

(9) Marking: All boxes must bear an indication of classification by weight and qualitative classification of the contents (de luxe or choice), the name of the variety, as well as the number of fruits.

Title 2.--National Emblem

Article 2.--The boxes containing oranges meeting the requirements specified above may be stamped with the national emblem.

Tangerines and Clementines

The exportation of tangerines and clementines has been subject to regulations since November 1933.

An Order dated November 9, 1933, determining the requirements which these products must meet when packed, was repealed by the Order of June 22, 1934.

By virtue of this latter Order, published in B.O. No. 1134 of July 12, 1934, and extended indefinitely by the Order of the D.A.E. under date of June 20, 1938, amended by the Order of the Director of Economic Affairs of July 15, 1938, published in B.O. No. 1342, the tangerines and clementines were actually placed under control.

General Control

Article 1.--The certificates of inspection relating to the shipments of tangerines and clementines must state that the inspected goods meet the following requirements, upon nonfulfillment of which the customs service will refuse embarkation:

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* Shipments to France are unwrapped. No wrapped pack of North African fruit was observed either in North Africa or France.

(1) Maturity and aspect: The tangerines and clementines must be colored, at least two-thirds of their surface showing the specific coloration which the fruit presents in its stage of ripeness and the remaining one-third showing the beginning of turning, without any green spot.

(2) Quality minima: All tangerines and clementines exported must be perfectly shaped and healthy and have their stems cut off neatly at sepal height; rejected as unfit for exportation will be fruit which is misshapen or thick-skinned or puffed, which has fallen (from the tree), or presents imperfections caused by frost or sirocco and shows signs of internal or external parasites (particularly the fruit-fly), and unhealed wounds.

Fruit containing small healed lesions or a few minor defects which in no way impair their proper conservation may be exported.

(3) Size and classification: Tangerines exported must have a minimum diameter of 57 or 61 mm, depending on whether they have a smooth or warty skin; clementines must have a diameter of 46 mm. The classification will be made according to the following calibers:

. . .

(4) Qualitative classification: The qualitative categories of choice will be thus defined:

De luxe tangerines: Fruit of perfect granulation, form, ripeness, with fine or semi-fine peel depending on the variety, but without any visible defect;

Choice tangerines: Fruit of proper maturity and regular shape; skin free from serious imperfections.

(5) Each box must be equal in makeup; that is, it must contain, bearing in mind the allowance made below, only fruit of the same variety and quality, size, shape, and coloration, and, as nearly as possible, the same skin granulation.

(6) Allowances: As concerns the coloration and difference in granulation, the allowance made is 5 percent in number for "de luxe" tangerines, and 8 percent for "choice" tangerines.

(7) Boxing: Only the following containers are authorized:

(a) Boxes, Morocco-type, of a gross weight of about 12 kilograms, bearing the following characteristics:

2 ends: 275 mm x 120 mm x 11 mm.
2 sides: 577 mm x 120 mm x 5 mm.
4 slats for top and bottom: 577 mm x 136 mm x 5 mm.
4 cleats: 220 mm x 15 mm x 10 mm.

The cleats of the top will be mounted flat and at both ends. The cleats of the bottom will be mounted flat and 25 mm. from the ends.

(b) Standard Sicilian boxes, of a gross weight of about 7 kilograms, bearing the following characteristics:

2 ends: 215 mm x 120 mm x 10 mm.
2 sides: 465 mm x 120 mm x 5 mm.
4 slats for top and bottom: 465 mm x 105 mm x 5 mm.
4 cleats: 200 mm x 15 mm x 10 mm.

The cleats of the top will be mounted flat and at both ends. The cleats of the bottom will be mounted flat and 20 mm. from the ends.

All containers used in the packing and exportation of tangerines and clementines must be new, of perfectly smooth wood (peeled, cut planed, or sawed thin), nonresinous, dry, and nonodorous.

Exemptions from the provisions of this Order may be granted by the Director of the Office Cherifien de Control et d'Export for the utilization of special packing material to serve in "on approval" shipments or shipments not of a commercial nature.

(8) Boxing: The inside walls of the boxes or crates must be lined with glazed paper or cardboard; the layers of fruit separated by a layer of cardboard or fiber and the top layer by a pad of fine fiber or cellophane or similar material; this top layer may contain fruit with the stem and a few leaves.

The use of straw, grass, or hay, or printed paper in the boxes is prohibited.

(9) Marking: All boxes must bear, an indication of the content, the classification by weight, the quality (de luxe or choice), and the number of pieces of fruit.

National Emblem

Article 2.--The crates, boxes, and cases, and small boxes containing tangerines, when meeting the above specifications may carry the national emblem.

Lemons

The exportation of lemons is subject to a directive dated March 10, 1936, and published in the B.O. No. 1221 of March 20, 1936, extended indefinitely by an Order of the D.A.E. under date of June 20, 1938.

Article 1.--The certificates of inspection relating to the shipments of lemons must state that the merchandise inspected complies with the following conditions, upon noncompliance with which the customs service will refuse embarkation:

(1) Maturity and aspect: The lemons must be colored, at least two-thirds of their surface showing the peculiar coloration which the fruit presents in its state of maturity.

(2) Quality minima: All exported lemons must be perfectly shaped and healthy; rejected as unfit for exportation is fruit which is misshapen or whose skin is too thick, has dropped (from the tree) or present imperfections caused by frost or sirocco, signs of internal or external parasites (particularly the fruit-fly), and of unhealed lesions.

The fruits with small healed lesions or a few minor defects which in no way prevent their proper preservation may be exported.

(3) Minimum size: The exported lemons must have a small diameter of at least 45 mm.

(4) Presentation for shipment: The boxes must contain only fruit of the same variety, quality, size, shape, coloration, and, as nearly as possible, the same skin granulation.

(5) Boxing: Only the following containers are authorized:

(a) Standard boxes, California-type, double-compartment, gross weight between 30 and 35 kilograms (660 x 290 x 290 mm.);

(b) Boxes Nos. 18 and 20, to the capital and Algeria only.

All these containers must be new, of smooth, nonresinous, dry nonodorous wood.

Wrapping: All lemons exported to countries other than France and Algeria must be wrapped separately in tissue paper, colored or plain, and stamped with the name of the packer or producer.

Bearing in mind the provisions set forth in the above paragraph, the lemons may be placed in the boxes without any further wrapping.

The inside walls of the boxes must be lined with glazed paper or cardboard. The top layer of fruit must be protected by a pad of fiber or cellophane or similar material.

The use of straw, grass, or hay, or printed paper in the boxes is prohibited.

(6) Marking: All boxes must bear an indication of their contents and of the number of pieces of fruit.

Article 2.--Allowances may be granted by the Director of the Office Cherifien de Control et d'Export insofar as packing and wrapping for "on approval" shipments is concerned and in case of force majeure.

Oranges for Industrial Use

Article 1.--Whoever (producer or exporter) desires to export oranges for industrial use must transmit to the Director of the Office Cherifien de Control et d'Export, prior to each shipment, a statement signed by his buyer certifying that the fruit making up this shipment is destined for industrial use. This document must bear the approval stamp of the Syndical Chamber to which the ultimate user of the oranges belongs.

Article 2.--The certificates of inspection relating to orange shipments exported under the designation "oranges for industrial use," must state that the merchandise inspected meets the following requirements, upon noncompliance with which the customs service will refuse shipment;

(1) Quality minima: All oranges exported must be perfectly shaped and healthy; oranges which are overly ripe, bear traces of external or internal parasites (particularly of the fruit-fly), and fruits with open lesions will be rejected as unfit for exportation.

Allowances may occasionally be granted as a provisional measure by the Director of the Office Cherifien de Control et d'Export for the exportation of shipments which do not fulfill exactly the established minimum provisions, if the imperfections will not prevent the proper preservation of the fruit in transit.

(2) Boxing: Only double-compartment crates weighing approximately 35 to 40 kilograms net are authorized.

(3) Wrapping: The inner walls of the crates must be lined with strong, perforated paper and the fruits placed inside in layers, one above the other, without paper wadding or inserted sheets of paper.

The use of straw, grass or hay, or printed paper in the crates is prohibited.

(4) Marking: All boxes must be marked on both ends with indelible ink: "Oranges for industrial use."

APPENDIX II

Citrus Varieties Grown at Experiment Station, Boufarik, Algeria, November 1947

Sour Orange (Root Stock) (Bigaradiers)

- Apepu
- Bouquetier de Nice
- du Japon
- Grand Louis
- Granito
- Ordinaire
- Pomme d'Adam (Adam's Apple)

Divers Citrus (Citrus Divers)

- Calamondin
- Citrus otaitensis
- Citrus triptera
- Microcitrus
- Kumquat
- Rhobs el arsa
- Rough Lemon
- Zemboua

Lemons (Citronniers)

- Bedmar
- Citron doux
- Dellys
- Eureka
- Kennedy
- Lisbon
- Lunari
- Meyer
- de Palerme
- Panache
- Remontant
- San Geronimo
- Sans pepins
- Sicily
- de Valence
- Villafranca

Citrons (Cedratiers)

- 116
- de Bombay
- Corsican
- digitte

Limes

- Acid lime
- Mexican
- Sweet lime
- Rangpur lime

Tangerines (Mandariniers)

- de Blida
- d'Australie
- de Bombay
- de Canton
- Cleopatra
- Dupre
- King of Siam
- Kino-Oro
- Kinokuni
- Mandarinette
- Mandarine Sanguine
- Owari Satsuma
- Wase Satsuma
- S. Saigon
- Temple
- Dancy Tangerine

Clementines (Clementiniers)

- de Sfax
- Merme
- Monreal original
- Monreal second generation
- Ordinaire

Tangelos

- de Californie
- Minneola
- Orlando
- Seminole
- Sampson
- San Jacinto
- Thornton
- Wekiwa
- Williams

Oranges (Orangers)

Alger-Navel
Ananas Signorelli
Blanche de Teneriffe
Blida
Brazilian
Boone
Cadenera
Cap Naartje
Carter Navel
Centennial
Conca d'Oro
Doble fina
Doble fina amelioree
  (Washington Sanguine)
Double Imperial Navel
Dura
Du Djerid
El Milia
Enterprise Seedless
Golden Buckeye
Golden Nugget
Grosse du Maroc
Hamlin
Hative de semis
Hart's Late
Homossassa
Jaffa
Kabyle des Mechtras
Kowa
Lue Gim Gong
Magnum Bonum
Maltese Oval
Maltese
Meski
Moro
Navelencia
Navel-non-pareil
Old Vini
Ovale Calabraise
  (Calabrian Oval)
Ovale de Sangre
Pineapple
Portugaise
Portugaise Chiris
Portugal
Parson Brown
Rayee du Bresil
Real
Robertson Navel
Sanguine de Biskra
Sanguine de Ferme-Blanche
Sanguine grosse ronde
Sanguine de Mustapha
Sanguine petite ronde
Ruby Blood
Sanguine Riccio
Sidi Ali
Sun of Summer
Sorbonne
Tabacchiera
Tardive Rovigo
Tetouan
Thomson Navel
Thomson panache
Tripoli
Valence de Ferme-Blanche
Valencia Late
Vernia
Washington Navel
Washington Navel Baraque
Zatima-navel
Zeg-zel

Shaddock (Pamplemousse)

Poire du Commandeur

Grapefruit (Pomelos)

Carleton
Duncan
Little River Seedless
Marsh Seedless
McCarty
Pink Marsh Seedless
Royal
Thompson
Foster